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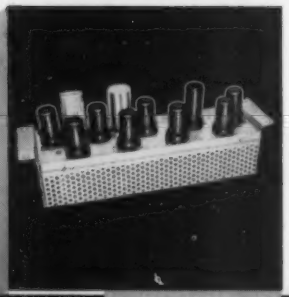

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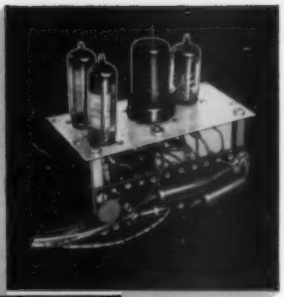

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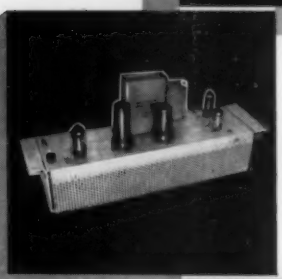

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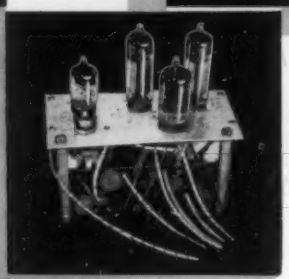

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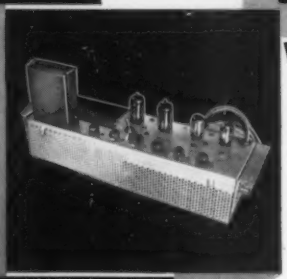

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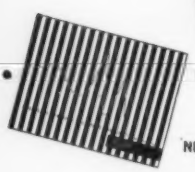

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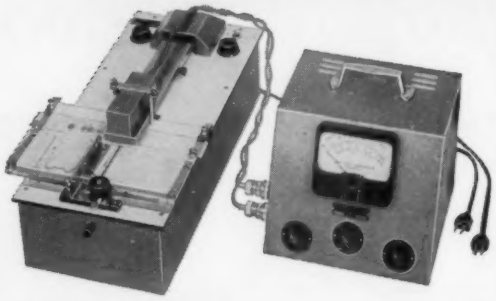

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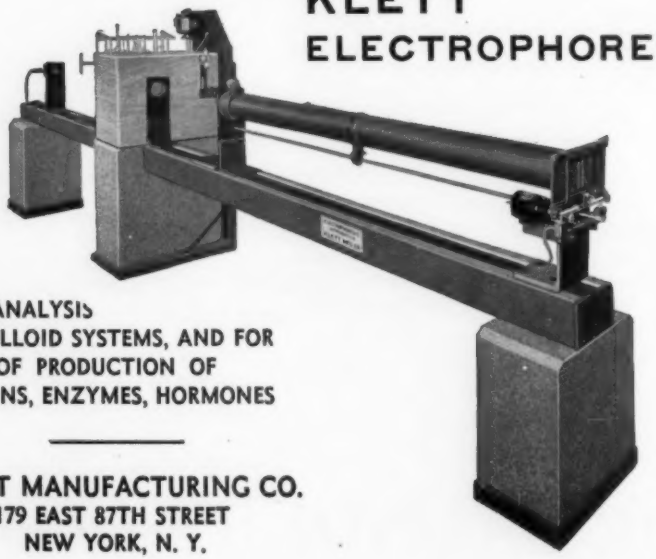

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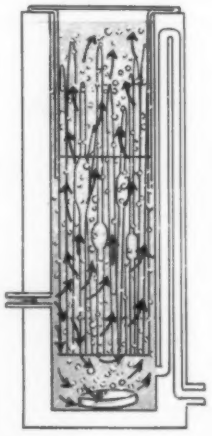

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Immigration Laws and the Foreign Visitor

United States laws passed since 1950 have seriously restricted the freedom of foreign citizens to visit our country. It is reasonable to examine again the effects of these laws upon the development of knowledge in the arts and sciences, upon security, and upon the image they create of the United States abroad.

Any restriction of communication has a deleterious effect upon the growth of knowledge. Formal and informal meetings of scholars are one of the most effective modes of communication. The current restriction on the visits of individual foreign scholars and scientists to the United States unquestionably limits the opportunity for the interchange of ideas here. Moreover, international conferences of learned societies are held less frequently in the United States than they might be because of the hazards and frictions that are created for some people; yet these same people might in the end get visas. Thus the restrictions on visits affect a much larger group of learned men than those whose visas are actually denied or delayed. Only a small fraction of United States citizens can afford to attend international meetings in foreign countries, while many could attend such meetings here. Yet it is obvious from history that the arts and sciences develop in an international field. Any people who build fences that limit this cross-fertilization may well make their own section of the field less productive than it would otherwise be.

Such restrictions can be justified only on the ground that they are essential to security. But our measures are gaining for the United States little or no security. The foreign scholars who are being excluded could do little or no harm under the conditions of their visits, even if they wanted to. They are not invited to visit classified projects; they are invited only to contribute to, and stimulate, the development of our knowledge in open meetings. Any patriot should be in full sympathy with all useful programs in behalf of security, but it is well to recall the classic illustration: the scientific knowledge that made possible the production of atomic energy was brought to this country voluntarily by certain of our foreign colleagues from countries with which we were at war. This supports the view that an open and free country stands to gain more than it stands to lose by virtue of its unrestrictive policies.

A restrictive policy toward foreign visitors works against our general welfare in still another way. Our seemingly arbitrary restrictions on the visits of our foreign colleagues have inevitably contributed to the impression that we mistrust them. An antipathy to the United States seems to be developing abroad, an antipathy that did not previously exist, along with a tendency to disdain us as we have disdained those other nations that have restricted freedom. The United States is damaged by the loss of the prestige and affection it once enjoyed as the land of the free.

It seems clear that our country should do everything it safely can to keep the doors open and to welcome guests who can give us much. Indeed the greater safety lies in such a course. It is to be hoped that the Congress will liberalize the statutes governing the entry of visitors and phrase the new laws so that they cannot easily be interpreted illiberally.

—JOHN E. BURCHARD

This editorial is based on statements made by Dean Burchard as president of the American Academy of Arts and Sciences before the United States Senate Judiciary Subcommittee on Immigration and Citizenship Laws, 1 Dec. 1955.

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Pituitary Growth Hormone as a Metabolic Hormone

Choh Hao Li

The removal of the pituitary from young growing animals induces atrophy of the adrenals, thyroid, and gonads, as well as stoppage of general body growth. The development, growth, and secretory activity of these endocrine glands are controlled by the hormones of the anterior pituitary. In this capacity, the pituitary hormones function as growth-promoting substances; all are specific with respect to their growth-promoting effects, with the exception of growth hormone, which affects the growth of the body as a whole (*1*). For example, adrenocorticotropic hormone (corticotropin, ACTH) causes hypertrophy of the adrenal cortex and induces the hypertrophied gland to secrete cortical hormones into the blood circulation. Without ACTH, the adrenal glands of hypophysectomized animals are forever atrophied, and no further growth of the gland can occur.

Growth and the Anterior Pituitary

However, it should be pointed out that the anterior pituitary is only one of the many agents that determine the ultimate size and form of the whole animal and its component organs. There is also good reason to believe that the presence of a pituitary factor is not always essential for growth.

Although it is known that hypophysectomy of very young rats does not lead to an immediate cessation of growth (*2, 3*), growth does cease when the young hypophysectomized rats reach an age of about 30 days (*4*). When rats are hypophysectomized at a very early age, their life span becomes extremely limited; such animals survive for less than 75 days (*5*). For instance, among several hundred rats hypophysectomized at 6 days of age, there was a mortality of 86 percent in the period immediately following operation (the first 10 postoperative days). During the next 13 days (up to 28 days of age) no deaths occurred; starting immediately thereafter (at 29 days of age), deaths in the 43 remaining untreated rats were frequent, until by 74 days of age all of them had died.

These deaths have been attributed to brain damage; the brain had continued to grow to normal size within a cranium that had become dwarfed through the premature arrest of its growth in both length and width. The chief factor in this arrest appeared to be the cessation of endochondral osteogenesis at the base of the skull. Before death, these animals were characterized by distinct abnormalities, which appeared in some cases as early as 20 days of age; virtually all of these abnormalities could be related to the nervous system. However, when these young hypophysectomized animals were treated with growth hormone, they survived, and furthermore, they manifested no evidence of neural damage. Apparently, the arrest of their cranial growth, both longitudinal and lateral, was counteracted by the growth hormone, so that the crania of the treated animals could attain normal size, adequately accommodating the brain.

This remarkable effect of growth hormone furnishes one of the best illustrations of its influence on the growth of bony tissue. In fact, the most sensitive and reliable method for the bioassay of growth hormone is based on its stimulation of the proximal epiphyseal cartilage of the tibia in young hypophysectomized rats (*6*). It should be mentioned that growth hormone does not cause skeletal maturation but is concerned chiefly in the process of osteogenesis (*7*).

When normal adult rats, maintained on a constant dietary intake, were injected with growth hormone, an increase in body weight with an accompanying decrease of urinary nitrogen was observed (*8*). Furthermore, it has been shown that the protein content in the bodies of hypophysectomized rats increases when the animals have received treatment with growth hormone (*9*). That growth hormone is a powerful protein anabolic agent gains additional support from experiments with sulfur-35-labeled albumin, in which the effect of growth hormone on the metabolism of plasma albumin was studied. It was found that treatment of the adult hypophysectomized rat with growth hormone results in a great acceleration of albumin synthesis, so that the replacement rate is increased twofold or more (*10*).

Adrenocorticotropic hormone is now well established as a growth inhibitor (*11*); administered to young normal rats, it retards their rate of growth, and it induces a similar stunting in young hypophysectomized rats (*12*). It has also been reported that ACTH injections inhibit hair growth (*13*). Furthermore, in experiments with normal rats, treatment with ACTH resulted in a retardation of both chondrogenesis and osteogenesis in the region of the proximal epiphysis of the tibia (*14*). Since growth hormone is a promoter of growth, it is not surprising that it can counteract the growth-inhibiting effect of ACTH; for example, the decrease in body weight and in the width of the epiphyseal cartilage that are usually induced by ACTH were halted completely, or almost completely, by the simultaneous administration of growth hormone (*15*). A similar antagonism between these two hormones has also been observed in the osseous system in hypophysectomized rats (*16*). Furthermore, it was found that growth hormone reverses the weight loss produced by the administration of ACTH or cortisone, without affecting the ability of the latter hormones to inhibit the growth of transplanted mammary adenocarcinomas in C3H mice (*17*).

The author is professor of biochemistry and experimental endocrinology at the University of California, Berkeley. This article is based on a lecture presented under the auspices of the Children's Cancer Research Foundation at Harvard Medical School, Boston, Mass., on 11 Oct. 1955.

Extra-"Somatotropic" Effects

Since the demonstration of growth-promoting activity in pituitary extracts by H. M. Evans and J. A. Long in 1921 (*18*), the chief function of growth hormone has been thought to be the promotion of somatic growth. However, the frequent failure of growth hormone to produce growth in human dwarfs has been a great disappointment to clinical endocrinologists in recent years, although Shorr *et al* (*19*) have recently reported enhanced storage of nitrogen, calcium, and phosphorus during the course of the administration of the hormone to two female subjects of abnormally small stature. It may be that growth hormone can exercise biological functions other than just the promotion of body growth. Indeed, recent studies from this laboratory (*20*) have demonstrated, in normal rats, the ability of growth hormone to effectively counteract the depression of resistance to *Pasteurella pestis* that is induced by relatively high doses of ACTH. In the same study it was shown that growth hormone, when administered simultaneously with ACTH, prevents the lowering of serum antibody levels that results from the administration of the latter hormone, following a single injection of a soluble protein antigen. Other investigators (*21*) have also obtained evidence of the beneficial effect of growth hormone on animals that have been sensitized by cortisone to tuberculosis infection.

There have been other indications of extra-"somatotropic"—in the restricted sense now generally accepted for this term—effects exercised by the growth hormone. After treatment of hypophysectomized female rats with growth hormone, an increase was noted in the weight of the uterus, and tall columnar mucous cells were discernible in the vagina; similar stimulation was observed in hypophysectomized-ovariectomized or hypophysectomized-adrenalectomized animals that had been treated with the hormone (*22*). It has also been demonstrated that growth hormone possesses an ability to effect partial restoration of the atrophied secondary sex organs of hypophysectomized-castrated male rats (*23*).

There is now much evidence to the effect that growth hormone administered to experimental animals produces typical signs of diabetes and causes various changes in carbohydrate metabolism (*24*) while recent data strongly suggest that growth hormone accelerates the mobilization and oxidation of depot fat (*25*). In view of these observations of the strong influence exercised by the growth hormone on the general processes of metabolism, it is not surprising that this hormone has been found to be galactopoietic in the cow (*26*) and that it has been further demonstrated to be essential for the induction of milk secretion in hypophysectomized rats (*27*).

Growth Hormone as a Biological Synergist

When growth hormone is administered concurrently with testosterone to young hypophysectomized-castrated male rats, the two hormones operate synergistically to promote the growth of the accessory sex glands (*28*). A similar synergism between ACTH and growth hormone with respect to the development and function of the adrenal glands of hypophysectomized animals has also been observed (*23*).

Regression of the mammary glands of hypophysectomized-castrated rats was apparent when the animals received either growth hormone or estrone alone. However, if these two hormones were injected together, synergistic effects were clearly evident in the remarkable end-bulb proliferation (*27*). In the absence of growth hormone, estrone exercises no biological action on the development of the mammary gland; the presence of growth hormone seems to bring out what may be the true physiological function of estrone. Does this ability to act as a synergist mean that growth hormone plays a permissive or supporting role in the biological action of a hormone or of a biological agent? It is not unreasonable to assume that growth hormone creates the necessary and sufficient environment for other biological agents to exercise the full scope of their functions.

Growth Hormone and Cancer

To further illustrate the supporting role played by growth hormone in biological phenomena, we may recall the early studies on the influence of growth hormone on the development of tumors in normal and hypophysectomized rats. When normal rats were treated with growth hormone for a period of 485 days, many neoplasms developed in the organs of all these animals (*29*). These lesions occurred most frequently in the lungs, adrenal medulla, and reproductive organs. However, no neoplastic response was noted in hypophysectomized animals that were similarly treated (*30*). It would appear that growth hormone is not in itself the cause of the development of tumors; in the presence of excessive growth-hormone stimulation, an unidentified substance becomes active and induces abnormal growth in the body of the animal.

It is known that hypophysectomy results in a marked suppression of the response of animals to carcinogens. Recent studies with 9,10-dimethyl-1,2-dibenzanthracene in rats indicate that this alteration of response produced by hypophysectomy manifests itself in delayed appearance of the neoplasms as well as in their lowered incidence (*31*). It was found, for example, that in rats with intact pituitaries, 50 percent of the animals developed tumors within 60 days after injection of the carcinogenic agent, whereas in hypophysectomized rats, 156 days elapsed before a 50-percent incidence of tumor development was reached. When the hypophysectomized rats were treated with growth hormone, the interval again approximated that encountered with the intact animals. Thus, it is evident that growth hormone plays a supporting role in connection with the carcinogenic action of dimethyl-dibenzanthracene in hypophysectomized rats; in the absence of growth hormone, the production of sarcomas by the carcinogenic agent is markedly delayed.

Concluding Remarks

This article (*32*) is not intended to be a summary of the biological properties of the growth hormone, nor is its purpose to present new data from our unpublished work. I wish primarily to call attention to the way in which the name of this hormone, adopted because of the first experimental observations on its action, has led to a misleading expectation about its biological activity and sometimes to a mistaken evaluation of its biological usefulness. When for many years the pituitary growth hormone was thought to possess only general body-growth-promoting activity, as its name indicates, any observed biological effects other than the promotion of growth were attributed to some contaminating factor or factors. At one time or another, the existence of glycotropic, pancreatropic, glycostatic, diabetogenic, and ketogenic principles in purified pituitary preparations that were also rich in growth-promoting activity was postulated. We now know that these effects can be attributed to the action of the growth hormone itself (*33*).

It should be borne in mind that a hormone known to be pure, and whose chemical structure has been elucidated—ACTH (*34*), for example—can exercise more than one biological function. Conversely, it should be borne in mind that molecules of differing chemical composition may possess similar biological activities. It is therefore not surprising that the growth hormone protein, which behaves as a homogeneous substance (*35*), exhibits a variety of metabolic effects.

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32. The work reported here has been supported in part by grants from the Albert and Mary Lasker Foundation and by the American Cancer Society on recommendation of the committee of Growth of the National Research Council.

33. Since so many effects involving various tissues and organs have now been ascribed to the pituitary "growth hormone," it might be more appropriate to designate the hormone *somatotropin*, if, avoiding the restrictive distinctions between somatic tissue and the visceral or generative organs that have led to confusion in recent years, we understand the term in its broad sense as implying something that nourishes or affects the whole body (*soma*).
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Fallout Dosages at Washington, D.C.

Irving H. Blifford, Jr. and Herbert B. Rosenstock

The ground-level concentration of fission products in the air has been measured daily for several years. Fission product activity at Washington, D.C., although it is readily detectable, has generally remained less than the natural background due to radium and thorium products that are normally present in the atmosphere. However, even with low air concentrations of long-lived activities, material deposited on the ground may conceivably lead to appreciable dosages for long exposures.

In this report, a calculation of the radiation dosage received by an unshielded man for all biologically significant time (here referred to as the "infinity dose") is therefore attempted from the measured air concentration of fission products and the estimated rate of fallout (*1*, *2*). Detailed calculations, to be sure, are not feasible on account of the many unknowns such as particle size, meteorological parameters, and so forth; but in view of the general lack of information on the subject, even a crude calculation based on experimental data is of interest.

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Data and Analysis

It will be assumed that the fission products are distributed in the lower atmosphere in the concentrations measured by our air filtration equipment (*2*). Our experimental data consisted of daily measurements of the atmospheric radioactivity collected by an efficient filter device. The collected radioactivity was measured with a thin-window Geiger counter, and the activity due to fission products was calculated from decay measurements. The estimated over-all accuracy of this determination is ± 20 percent. Figure 1 is an example of the raw filtration data obtained during 1953 and 1954. The earlier and most prominent responses observed during 1953 were due to United States tests in Nevada, while those later in the year followed tests in the Soviet Union. Subsequent to the Pacific thermonuclear tests of 1954, the atmospheric fission product concentration increased gradually from June to September, when much larger activities from Soviet tests appeared.

If $a(t)\,dt$ represents the number of fission product disintegrations at time t in time interval dt per unit volume, the total number $n(t)$ of disintegrations that take place per unit volume after a time t will be

$$n(t) = \int_t^\infty a(t_1)\,dt_1. \qquad (1)$$

(This is also the number of radioactive atoms contained in a unit volume at time t.) According to Way and Wigner (*3*), the time dependence after 1 day is given by

$$a(t_1) = ct_1^{-1.2} \qquad (2)$$

where c is a constant. One measurement at $t_1 = t$ suffices to determine the constant c. Evaluating Eq. 1 by means of Eq. 2, we obtain

$$n(t) = \int_t^\infty a(t)\,(t/t_1)^{1.2}\,dt_1 = 5a(t)t. \quad (3)$$

If V_1 is the velocity of fallout, the total number of radioactive particles that will fall on a unit of area (and later disintegrate there) is then simply $5\,V_1 a(t)t$. The total number of radioactive atoms N that fall on a unit area due to deposition from the entire volume directly above is then

$$N = 5\int_0^\infty V_1 a(t)\,t\,dt. \qquad (4)$$

(This is also the total number of disintegrations that will occur per unit area for all time.)

Although Eq. 2 is not valid at $t = 0$, the lower limit of Eq. 4 causes no difficulty since, at some distance from the explosion, $a(t)$ usually remains zero for the first few days after detonation. Under the assumption that each measured beta disintegration corresponds to one gamma

ray of about 1 Mev (*4*), the infinity dosage R in roentgens can be calculated in a straightforward way to be

$$R = \frac{N}{2.7 \times 10^{12}} \qquad (5)$$

when N is given in disintegrations per square foot.

If the rates of fission product disintegrations $a(t)$, the time t that has elapsed since the explosion, and the velocity of fallout V_1 are known, the infinity dose due to any one explosion can be calculated from Eqs. 4 and 5. The calculation may then be repeated for all other explosions to give the total infinity dose due to all past explosions.

Of these three required quantities, the first has been measured with adequate precision (*2*). For the second, one is faced with the difficulty that only the total activity can be measured on any one day, and not the separate activities due to separate past explosions. Therefore, it has been necessary in several instances to assign certain fractions of a given disintegration rate to different explosions in what appeared to be a reasonable, but somewhat arbitrary manner. The final results, fortunately, are not very sensitive to fairly large mistakes in this assignment. For the third quantity, V_1, the situation is less satisfactory.

No daily record of V_1 is available. The quantity must therefore be taken outside the integral sign in Eq. 4 and an average value used. This will lead to a good approximation only if V_1 is reasonably constant, a condition that, in fact, is not satisfied. The measured values ranged all the way from 700 to 500,000 feet per day with an average of 40,000 feet per day (*2*). The high values are quite rare and, incidentally, are correlated with rainfall. It follows that if a day with very large V_1 occurred soon after an explosion (that is, at a time when $a(t)$ was high) our results for this explosion would be too low, whereas if no such day occurred until $a(t)$ due to one explosion has decayed to a small fraction of its original value, our results for that explosion would be much too high. The possibility that such errors occurred in individual cases cannot be excluded. However, the main interest of the present article is not in the dosage due to individual explosions, but in the total dosage accumulated over several years. In so long a time, the errors will largely compensate.

The measurements of V_1 from which the average of 40,000 feet per day was obtained were made by comparing air-filter measurements of atmospheric radioactivity with simultaneous measurements of fission products deposited on the ground over a period of 6 months (*2*). Earlier measurements on naturally radioactive substances have given lower figures (*5*). Furthermore, the entire "lower atmosphere" would be exhausted in 1 day if the fallout velocity were as high as 40,000 feet per day. It is felt, therefore, that the average velocity that has been used here, if not correct, must be high. Since V_1 is by far the least certain of the required data, the calculated infinity dos-

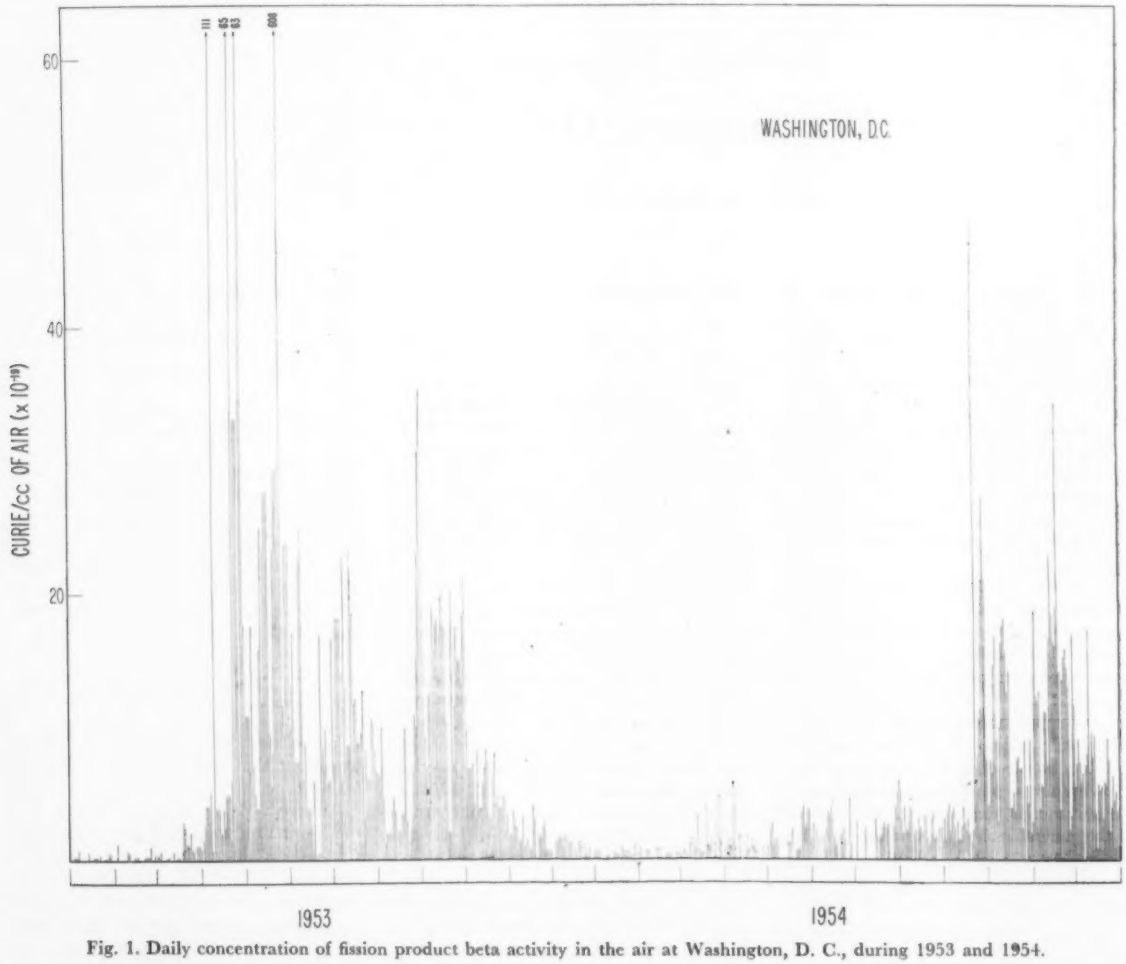

Fig. 1. Daily concentration of fission product beta activity in the air at Washington, D. C., during 1953 and 1954.

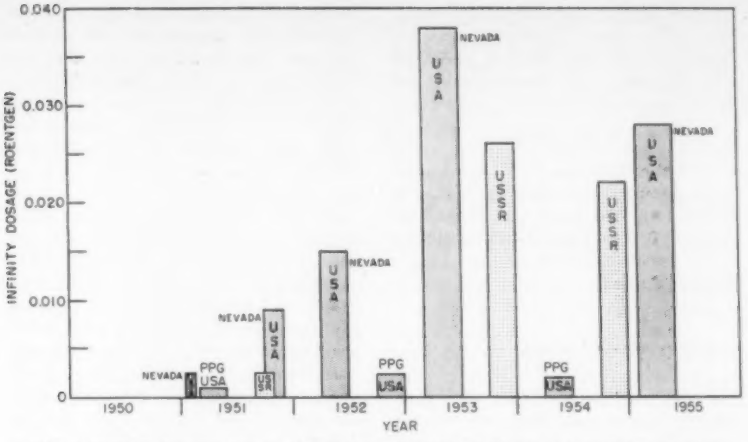

Fig. 2. Infinity dosages due to fallout from the United States and Soviet test series.

ages are probably also too high rather than too low.

Figure 2 shows the infinity dosage at Washington, D.C., for the known tests from January 1951 through May 1955. The dosages were obtained from the described direct measurements and numerical integration of Eq. 4 together with Eq. 5. The highest calculated dosage due to any one test was 0.038 roentgen (Nevada tests of the spring of 1953), and the lowest was about 0.001 roentgen (Pacific tests of the spring of 1951). The width of the bars corresponds only roughly to the actual periods of the tests.

Table 1 gives the calculated infinity dosages in Washington, D.C., from both the United States and the Soviet tests as less than 0.2 roentgen. For the aforementioned reasons, this result claims order-of-magnitude accuracy only, but it is almost certain to be an upper limit. About 60 percent of the total dosage is seen to come from the Nevada tests, about 33 percent from the Soviet tests. Owing to likely cancellation of any systematic errors in the collection or interpretation of data, these percentages should be somewhat more reliable.

The Pacific tests contributed only about 7 percent of the total fallout dosage at Washington, D.C. This result may be regarded as somewhat surprising since the total energy released and therefore the quantity of fission debris undoubtedly far exceeded the combined total of all other tests. The fallout outside the immediate area of detonation is thus observed to be a much stronger function of distance than of energy release.

Table 1. Infinity dosages due to fallout at Washington, D.C.

Test	Total infinity dosage (roentgens)
U.S. Nevada	0.093
U.S. Pacific	0.012
U.S.S.R.	0.051
Total	0.156

In this calculation, the possibility that some of the fission particulates remain suspended in the stratosphere for long times has been ignored. Ordinarily, the fission products appear to be removed from the lower atmosphere relatively quickly. The primary agency seems to be rainfall; Stokes' law fallout probably plays a secondary role. However, it is known that the clouds of radioactivity from thermonuclear weapons rise to heights far above the level of precipitation. In this case, it is possible that a reservoir of radioactive debris could be formed in the upper atmosphere. The rate of fall into the precipitation level is very likely slow compared with the rate of wash-out by rain. If this is the case, measurements of the concentration of fission products in the air after a thermonuclear explosion should show the fairly rapid initial decrease with time that is usually observed after pure fission explosions, followed by a subsequent rise due to the penetration of high-altitude activity into the troposphere.

There does, indeed, seem to be experimental evidence for this effect from ground-level measurements of air activity. Figures 3 and 4 show the normalized fission activity per unit volume of air at several locations for the period of approximately 50 to 140 days after the thermonuclear tests of the spring of 1954. The curves were obtained by correcting the measured daily air concentrations for decay using the $t^{-1.2}$ law. In Fig. 3 it will be observed that all four locations gave somewhat similar responses. Generally, there seemed to be a minimum in the vicinity of 100 days and a rise thereafter to a more or less constant value. The initial decrease was more pronounced at Subic Bay, probably because of high residual activity from low-level clouds of fission products.

At San Francisco and Honolulu (Fig. 4), the relative fission activity concentration still appeared to be increasing at 140 days. The Soviet tests of the fall of 1954 and the United States tests in Nevada in the spring of 1955 have prevented continuation of these particular measurements. These phenomena were not observed (at least in such a marked manner) after any of the atomic explosions prior to the thermonuclear tests of 1954.

On the basis of these measurements, a simple mathematical model is proposed to estimate the additional fallout that is not included in the previous calculation. The distribution of radioactivity in the lower atmosphere is assumed to be irregular below the level of precipitation h_1, (approximately 40,000 feet) and more or less uniform above it, to an upper limit h_{max} of about 120,000 feet (estimated height of original cloud). The velocity of fallout V_2 in the upper atmosphere is assumed to be much smaller than V_1. The activity in the lower atmosphere is assumed to be exhausted at time T. Radioactivity from the upper level will appear at some later time at ground level

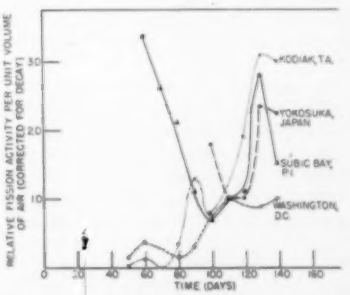

Fig. 3. Relative fission product activity per unit volume of air at Kodiak, Alaska; Yokosuka, Japan; Subic Bay, Philippines; and Washington, D.C.

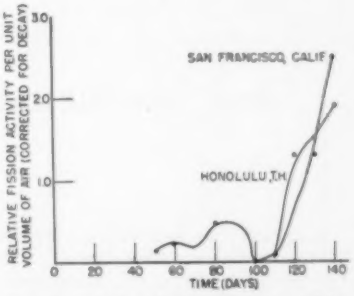

Fig. 4. Relative fission product activity per unit volume of air at San Francisco, Calif., and Honolulu, Hawaii.

and will remain substantially constant (except for radioactive decay) until at t_{max} the upper level activity is also exhausted. Therefore, Eq. 4 may be split into two parts:

$$N = N_1 + N_2 \tag{6a}$$

$$N_1 = 5V_1 \int_0^T a(t)\,t\,dt \tag{6b}$$

$$N_2 = 5V_2 \int_T^{t_{max}} a(t)\,t\,dt \tag{6c}$$

The dosage R resulting from N_1 alone is that given in Fig. 2. For $t > T$, the relationship of Eq. 1 holds in the form

$$a(t)\,t^{1.2} = a(T)\,T^{1.2}$$

and Eq. 6c becomes

$$N_2 = (50/8)\,V_2 a(T)\,T^{1.2} \left[(t_{max}/T)^{0.8} - 1\right] \tag{7}$$

The time it takes to clear the lower atmosphere is given by $T = h_1/V_1$. The time required to exhaust both the upper and lower regions is

$$t_{max} = \frac{h_{max} - h_1}{V_2} + \frac{h_1}{V_1}$$

or, if $V_2 << V_1$ and $h_{max} = 3h_1$, then

$$t_{max} = 2h_1/V_2.$$

Using these relationships, Eq. 7 may be written

$$N_2 = (50/8)\,a(T)\,T\,h_1 \left\{\frac{V_2}{V_1}\left[\left(2\,\frac{V_1}{V_2}\right)^{0.8} - 1\right]\right\}. \tag{8}$$

The quantity between the braces in Eq. 8 differs from unity by a factor of less than 3 for all V_1/V_2 between 1 and 10,000. It may therefore be neglected for the purposes of this calculation.

Figures 3 and 4 suggest that the experimental value for T was about 100 days, and the average observed air concentration $a(T)$ was 21 disintegrations per cubic foot, per day. With h_1 as 40,000 feet, the number of disintegrations per square foot for all time then becomes

$$N_2 = 5.3 \times 10^6.$$

Therefore from Eq. 5, the total infinity dosage at Washington, D.C., due to fallout from the upper level would be about 2×10^{-4} roentgen. This is, of course, a very small addition to the dosages given in Table 1.

Summary and Discussion

It has been assumed that the fission product conglomerate emits one gamma ray per beta particle throughout its lifetime. The fallout velocities are not accurately known, and in some cases the detonation and response times have been approximated. For these reasons, the dosages reported in this paper can be accurate in order of magnitude only. With these reservations, an infinity dose of 0.2 roentgen or less due to all explosions between January 1951 and May 1955 is reported for Washington, D.C. Therefore, it is probable that the total fallout from all weapons tests that have so far been conducted will produce only a fraction of the lifetime dosage due to natural radioactivity and cosmic radiation (*6*).

Most of the dosage comes from the Nevada tests, and only a small part from the Pacific thermonuclear tests (*7*). Fission products contained in that part of the cloud of a thermonuclear explosion which extends above the level of precipitation is found to contribute only very slightly to the dosage at great distances. No analysis was carried out for air activity data taken at other locations, but their qualitative similarity to those taken in Washington suggests that infinity doses in most other locations in the northern hemisphere will not be greatly different.

Present results are in essential agreement with two other measurements that have been reported. Eisenbud and Harley (*8*) have measured fallout deposited on gummed papers (*9*) at various locations in the United States and have found an average dose of 0.001 roentgen per year. Stewart, Crooks, and Fisher (*10*) have measured the activity of air, rainwater, and ground deposits in England and report an infinity dose of 0.055 roentgen. This somewhat lower figure may result from their greater distance from Nevada, which appears to be the source of most of the fallout in the United States.

The authors wish to thank Dr. H. Friedman and Dr. L. B. Lockhart for their continued support and for many helpful discussions.

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R. C. Archibald and Mathematics Libraries

Raymond Clare Archibald was born in Colchester County, Nova Scotia, on 7 October 1875, the son of Abram Newcomb and Mary Mellish Archibald. When he was a small boy, his father died, and Raymond was brought up by his mother. During his youth she held a position as teacher in the Mount Allison Ladies College at Sackville, New Brunswick, and Archibald was himself graduated from Mount Allison University when still but 18 years old. At this time he received an A.B. degree with first class honors in mathematics and a teacher's diploma in violin. Presently he continued his studies at Harvard University, where he was awarded a second bachelor's degree in 1896 and a master's degree in 1897. After one more year of graduate study there, he went to Germany for 2 years. The first was spent at the University of Berlin and the second at the University of Strasbourg, from which he received his doctor's degree in 1900. Later on (1909–10) he studied for a year at the Sorbonne and still later (1922) for a short time at the University of Rome.

During the years 1894–95 and 1900–07 he taught in the Mount Allison Ladies College. Some of his duties were in mathematics, but in later years he used

to refer more often to his teaching of the violin during this period. He was also given responsibilities in the library, which he "developed from nothing to 12,000 volumes and catalogued by writing 30,000 cards by hand."

After a year as professor of mathematics at Acadia University in Wolfville, Nova Scotia, he was brought to Brown University as instructor in 1908. He now felt that he must banish music almost completely from his life and devote all his energies to mathematics in order to make a success of his work.

When, as a freshman in Brown University in 1915–16, I first came to know Archibald, he was my teacher. Then he was in the prime of life and full of energy. He was striking in appearance, his hair wavy and beginning to gray, worn a little longer than was generally the custom; his eyes large and expressive. Always carefully groomed, he wore a high starched collar and stiff detachable cuffs. Often a white edging on his waistcoat gave an added touch of elegance to his dress. To me he was an impressive figure among the Brown faculty.

Archibald firmly believed that the relationship between teacher and student should be personal and friendly and close. It was his custom to make appointments with each student in his classes for one or two half-hour conferences each semester. Thus I came to know him outside the classroom, and in these conferences he gave me encouragement in my work and fostered the growth of my interest in mathematics.

In 1908 the mathematical library at Brown, though well selected, was of small proportions. It was not difficult, after Archibald's introduction to library work at Mount Allison, to enlist his interest in developing and enlarging the mathematical library here. He threw himself into this task with a will and in the course of 10 or 15 years brought the library to a position of excellence. By the 1940's it had become generally recognized as one of the half-dozen best in America. During the period 1920–40 Archibald, without doubt, knew more about mathematical books and their values than anyone else in this country. Frequently he went to Europe for the summer, always provided with funds to spend for mathematics books for Brown. He carried on a flourishing correspondence with scientific booksellers throughout the world, and if a dealer offered an item for sale at less than it was worth he was on occasion quick to recognize the bargain and to cable an order for purchase.

During these same years he was devoting himself with great success to the upbuilding of two other libraries. From 1921 to 1941, as librarian of the American Mathematical Society, he supervised the growth of the society's library, which was developed largely through exchange of publications. The other library that received his constant and affectionate attention during these years and in the later years, after his retirement from teaching in 1943, is the Mary Mellish Archibald Memorial Library (of English and American poetry and drama) at Mount Allison University. This remarkable collection, his gift to Mount Allison, now contains "about 27,000 volumes, 2,700 gramophone records, and 70,000 songs with piano accompaniment."

Archibald was the author of a number of books including *Carlyle's First Love, Margaret Gordon, Lady Bannerman* (1910); *Euclid's Book on Division of Figures with a Restoration* (1915); *Klein's Famous Problems of Elementary Geometry*, revised edition (1930); and *A Semicentennial History of the American Mathematical Society, 1888–1938* (1938). His *Outline of the History of Mathematics* (1932) is widely used in courses in this subject throughout the United States and was successively revised up to the sixth edition in 1949. He contributed a number of articles to the *Encyclopaedia Britannica* and to the *Dictionary of American Biography* and a valuable bibliography of Egyptian and Babylonian mathematics to the edition of the *Rhind Mathematical Papyrus* published by Chace, Bull, and Manning (1929). At one time or another he served on the editorial boards of half a dozen periodicals and in 1919–21 was editor-in-chief of the *American Mathematical Monthly*, official organ of the Mathematical Association of America.

All his life he had a special interest in mathematical tables, and in 1939 the National Research Council made him chairman of a committee to study and report on the general situation with regard to tables. His committee found that the usual kind of report, ending this matter once and for all, would fall far short of the present-day needs of the scientific community, and that these needs could best be met by publishing a periodical that would constantly advise workers everywhere of new developments in this area of science. This led to the founding of the journal *Mathematical Tables and Other Aids to Computation*, with Archibald as its editor and a strong group of younger men as associates. Since World War II the tremendous expansion of interest and activity in high-speed computing machines, electronic and otherwise, has brought to this new journal an ever-increasing field of usefulness and significance.

With the passage of the years, many well-deserved distinctions came to Archibald from institutions on both sides of the Atlantic. Honorary degrees, memberships in academies of science and foreign mathematical societies, all paid tribute to the high regard in which he was held by friends everywhere and in many cases acknowledged services generously performed and freely given. He was president of the Mathematical Association in 1922, vice president and chairman of Section A, Mathematics, of the American Association for the Advancement of Science in 1928, and in 1937 was vice president and chairman of Section L, History and Philosophy of Science.

Archibald was both a scholar of the old school and a gentleman of the old school as most of us now regard it. He was brought up in the classical tradition with much emphasis on Latin and Greek. He had a very remarkable memory, and he carried with him at all times an enormous store of factual information in the fields of his interest. His death on 26 July 1955, in Sackville, brought to a close the life of a man who will long be remembered for his kindness, his unwillingness to compromise his standards, and his deep devotion to Brown University.

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The real problem in the years ahead is one of making the most efficient use of all our national resources—and not the least of these resources is our intelligent youth.—GEORGE A. SLOAN.

News of Science

AAAS Sections Call for Papers for the New York Meeting

Nine sections of the association will arrange sessions for contributed papers at the New York meeting, 26–31 Dec. 1956. The secretaries to whom titles and brief abstracts should be sent, *not later than 30 Sept. 1956,* follow:

C–Chemistry. Dr. Ed. F. Degering, 26 Robinhood Road, Natick, Mass.

E–Geology and Geography. Dr. Robert L. Nichols, Department of Geology, Tufts University, Medford, Mass.

G–Botanical Sciences. (Probably; in cooperation with botanical societies.) Dr. Barry Commoner, Henry Shaw School of Botany, Washington University, St. Louis 5, Mo.

H–Anthropology. Dr. Gabriel Lasker, Wayne University College of Medicine, 1401 Rivard Street, Detroit 7, Mich.

I–Psychology. Dr. Conrad G. Mueller, Department of Psychology, Columbia University, New York 27, N. Y.

L–History and Philosophy of Science. Dr. Jane M. Oppenheimer, Department of Biology, Bryn Mawr College, Bryn Mawr, Pa.

Nd–Dentistry. Dr. George C. Paffenbarger, American Dental Association Research Fellowship, National Bureau of Standards, Washington 25, D.C.

Np–Pharmacy. Dr. John E. Christian, School of Pharmacy, Purdue University, Lafayette, Ind.

Q–Education. Dr. Herbert A. Smith, 205 Bailey, School of Education, University of Kansas, Lawrence, Kan.

STIP Study on the Use of Science Counselors

Administrative agreements have been signed with the University of Nebraska, University of Oregon, Pennsylvania State University, and University of Texas for the Study on the Use of Science Counselors that is being sponsored by the AAAS Science Teaching Improvement Program. Under the agreement, STIP provides a grant to each university to operate a center for the study. Each university will name a coordinator for the center and employ two experienced teachers to serve as science counselors during the academic year 1956–57. The counselors will visit secondary schools in the territory surrounding the university, assisting and counseling with the science and mathematics teachers in these schools.

It is suggested that as many high schools be included in a center as will be required to include 100 to 150 full-time science and mathematics teachers. In each center an advisory committee, consisting of representatives of the departments of biology (botany and/or zoology), chemistry, education, mathematics, and physics, will be established.

It it the purpose of the Study on the Use of Science Counselors to test a method for increasing the competence of teachers, many of whom are relatively inexperienced and may be lacking in several aspects of desirable preparation. Many teachers of science would profit from improved laboratory and demonstration techniques and greater knowledge of subject matter, with stress on recent developments.

It is hoped that the study will be completed before the scarcity of science teachers reaches its peak, and that the results will point to a method for alleviating the shortage, perhaps a method that will merit support by public funds. It is believed that a science counselor with desirable breadth and depth of training in the sciences and mathematics, with a background of outstanding accomplishment in teaching, a natural ability to work with people, and practical knowledge of the learning process, can stimulate and improve the work of a small group of less well-prepared and more inexperienced teachers.

In addition to making effective use of teacher counselors, the study is intended to bring staff members in science, mathematics, and education into closer working relationships on a problem of common concern, and to bring college and university science staffs into closer communication with secondary schools. The study will provide for direct services by the universities to secondary schools. The university will be responsible for forming satisfactory working relationships with the participating schools and for obtaining the approval and cooperation of the state departments of education. It is suggested that whenever possible a counselor be made at least a nominal member of the state education department.

The centers were selected by an advisory board that consists of J. W. Buchta, professor of physics at the University of Minnesota; John Richardson, professor of science education at Ohio State University; and B. L. Dodds, dean of the College of Education at the University of Illinois. The director of STIP is chairman. The center coordinators are also to serve as members of the advisory board. The board will plan an evaluation of the study with the assistance of the centers and the cooperating schools.

The Study on the Use of Science Counselors will continue through one academic year, for which the grants have been made, and it is expected that the project will be extended for a second year. A 5-day conference for center coordinators and counselors will be held on the campus of the University of Colorado 19–23 June.

John R. Mayor, director
Science Teaching Improvement Program

Small Industries Training Program

The first training program for small industries to be held under the auspices of the United Nations Technical Assistance Administration was concluded with a special ceremony at the Technological Institute in Copenhagen 20 Mar. The program enabled 19 qualified persons from 16 economically less advanced countries to study new techniques and methods in their particular fields.

The program was organized by TAA in cooperation with the Government of Denmark, the Copenhagen Technological Institute, the International Labor Organization and the United Nations Educational, Scientific, and Cultural Organization. The TAA sponsored 12 fellowships, the ILO four, and UNESCO three. The countries represented were Brazil, Burma, China, Colombia, Costa Rica, Egypt, Haiti, Indonesia, Iran, Iraq, Israel, Jordan, Pakistan, the Philippines, Thailand, and Yugoslavia.

Dosage Schedule for Salk Vaccine

According to Hart E. Van Riper, medical director of the National Foundation for Infantile Paralysis, the following compromise, or emergency, dosage schedule for Salk vaccine that comes into the physician's private practice seems warranted under current conditions of supply.

1) Do not give "booster" shots between 15 Mar. and 1 July. There is minimal risk if, in fact, any at all, in giving

primary or booster shots *during* the polio season.

2) Use all available vaccine immediately. Do not save it for "second shots," even though a sterilely punctured vial of vaccine can be kept under refrigeration for an indefinite length of time without impairing either the safety or the potency of the vaccine.

3) The increasing supply of vaccine should be depended on for second injections in 1956. The exact interval recommended between the first and second doses is not critical, so long as it is not less than 2 weeks. In fact, longer intervals seem to be advantageous. Therefore, the second dose may be given at anytime without losing the benefit of the first.

4) The third dose should be given not less than 7 months after the second but may be given at any length of time thereafter.

On 13 Mar. the Surgeon General of the U.S. Public Health Service issued a statement endorsing the postponement of "booster shots" as a temporary measure "to enable more children to receive first or second doses and thus extend protection to more before this summer's poliomyelitis season."

On the basis of reports from manufacturers and the Surgeon General of the U.S. Public Health Service concerning estimated vaccine production, there is reason to believe that an adequate supply should be available for distribution before the seasonal advent of poliomyelitis in different regions of the United States. How much of this will get into the hands of private physicians is variable, depending on decisions of state and local health authorities and their advisory committees.

If the expected supply becomes available, it should be about enough to provide a high degree of protection against paralytic poliomyelitis before the 1956 polio season to all children in the most susceptible age groups (6 months through 14 years) and pregnant women who request it. In round numbers, there are approximately 50 million individuals in these categories. At least 10, and probably 15, million children have already received one or more injections of Salk vaccine. This leaves about 35 million children to be vaccinated on an emergency basis before the 1956 polio season.

Granting rapid and equitable distribution and no unexpected delays in processing and releasing vaccine (which requires a minimum of 120 days), there should be just about enough vaccine to give at least one, and usually two, injections each to 35 million people.

The ideal dosage schedule currently recommended is: Two 1-cubic centimeter injections, spaced 2 to 6 weeks apart, with a third 1-cubic centimeter booster injection given not earlier than 7 months later. Ideally, the first two injections should be given immediately after the previous polio season, in the late fall, with the booster injection being administered just before the subsequent polio season. It is easy to see that this is a schedule impossible to follow under the emergency conditions of 1956.

In the future, vaccination against paralytic poliomyelitis, undoubtedly, will become a standard pediatric procedure, with a schedule of injections beginning at 6 to 9 months of age. But realistic consideration of the current situation shows that the effectiveness of the vaccine depends on the mass of antigen administered and the number and spacing of inoculations.

Plans for Atomic Power

The plans of the Soviet Union, the United Kingdom, and the United States for the production of electric power from nuclear energy have been outlined in general at a meeting in Bangalore, India, of the Electric Power Subcommittee of the United Nations Economic Commission for Asia and the Far East.

Frank Maddocks of the United Kingdom pointed out that the development of atomic energy is vital to his country, for coal is getting scarce and expensive. Britain must, therefore, embark on an ambitious atomic energy program as a practical proposition. Maddocks said that a prototype generating station in the north of England is nearing completion and will begin supplying electric power toward the end of this year. Twelve stations to be built over the next 10 years, of which two will be built next year and two more the following year, should supply a total of some 2 million kilowatts, he said. The four stations being built over the next 2 years should, by 1963, add between 400,000 to 800,000 kilowatts to the national grid.

The experience of the United Kingdom, Maddocks went on, would be made available to other countries. In this connection, he remarked that arrangements for training had already been made with India and Pakistan through the Colombo Plan. He added that the United Kingdom would be short of nuclear fuel for the next 5 years.

Speaking for the United States, Samuel F. Neville said that atomic power plants with a total estimated capacity of 750,000 kilowatts are under construction or being designed, including a fast breeder reactor of 100,000 kilowatts near Detroit, Mich. In the United States program, said Neville, atomic energy production must compete with power from conventional fuels. It is not expected that such a stage will be reached before the second or third generation of reactors come into operation.

He pointed out that the United States has an installed electric power capacity of 115 million kilowatts and that it is estimated that, by 1975, it will need an installed capacity of from 360 million to 420 million kilowatts. By that time, he said, it is expected that atomic energy will supply some 40 million to 50 million kilowatts.

Nikolai M. Chuprakov, of the Soviet Union, said that the first atomic power station in the world using uranium had been operating in the U.S.S.R. since 1954, and that his Government is building 2000-kilowatt experimental atomic reactors to be used for training in Poland, Czechoslovakia, Rumania, Hungary, Bulgaria, and East Germany, and a 6500-kilowatt reactor for the Chinese People's Republic. Chuprakov remarked that the U.S.S.R. charges nothing for giving its experience, requiring payment only for the cost of the equipment it supplies.

News Briefs

■ The $20-million suit for patent infringement that was filed in 1954 by Mary Marcus against Selman A. Waksman, the Rutgers Research and Endowment Foundation, and Merck and Company [*Science* **120**, 966 (10 Dec. 1954); **121**, 11 (7 Jan. 1955)] was dismissed on 26 Mar. by Federal Judge Thomas F. Meaney of the New Jersey District Court. He commented that

"It seems to me that Miss Marcus has consistently evaded all the processes of this court and has completely failed to give a satisfactory reason why she has not appeared for a deposition. She has been acting in bad faith throughout the case."

■ On 28 Apr. the Harvard Observatory Council is inviting the eastern astronomers and radio astronomers, and some friends of Harvard Observatory and the 21cm Project, to participate in ceremonies for the dedication of a new 60-foot steerable radio telescope and the associated electronic equipment at the G. R. Agassiz Station near Harvard, Mass. However, the equipment is not expected to be in full operation until 6 weeks after the dedication.

Participants in the program for the day are as follows: Bart J. Bok of Harvard University; Robert J. Grenzback of D. S. Kennedy and Company, Cohasset, Mass., builders of the new radio telescope; Harold I. Ewen, codirector of the 21cm Project at Agassiz Station and builder of the electronic unit; Donald H. Menzel of Harvard University; Alan T. Waterman, director of the National Sci-

ence Foundation; Edward M. Purcell of Harvard University; David S. Heeschen, the present G. R. Agassiz radio astronomer; and A. Edward Lilley of the Naval Research Laboratory.

■ A map of the heavens as they appear from radio waves rather than light has been made at Ohio State University. H. C. Ko described the chart, which records 70 percent of the sky, at the recent meeting of the American Astronomical Society. The map shows the distribution of radio waves of 250 megacycles from the celestial sphere visible at Columbus, Ohio.

■ The 16 faculty members dismissed by the University of California for refusal to sign a loyalty oath in 1950 will be given a total of $162,000 in back pay. Individual payments will range from $2050 to $23,116. Following a January 1953 ruling of the California Supreme Court that the oath was illegal, the 16 were returned to their jobs.

■ A "united institute of nuclear research" will be established in the Soviet Union to provide a coordinated atomic and thermonuclear research program for Communist countries. The U.S.S.R. announced plans for the institute on 26 Mar.

The announcement said the Soviet Union will turn over to the new organization its Institute of Nuclear Research, including its laboratory of electrophysics and a 680-mev synchroton. Plans also were announced for construction of a new cyclotron, a laboratory of neutron physics, and a laboratory of theoretical physics.

The countries that signed the cooperative agreement are the People's Republic of China, Bulgaria, Hungary, North Korea, Mongolia, Poland, Romania, Czechoslovakia, and East Germany. North Vietnam has been invited to join the institute.

Scientists in the News

Viking Fund medals and an award of $1000 each were presented to three men at the annual award dinner of the Wenner-Gren Foundation for Anthropological Research in New York on 2 Mar. The recipients were as follows:

A. IRVING HALLOWELL, professor of anthropology and curator of social anthropology in the Museum of the University of Pennsylvania. The citation read, in part, "From an early start in social work he turned to anthropology as a formal discipline, developing an exemplary breadth of interest. This is reflected in the more than sixty papers and monographs he has authored which range with facility through prehistory, physical anthropology, ethnography, ethnology, personality and culture. . . .

"Hallowell is the leading scholar today in the study of personality and culture. Scheduled to appear this spring is a book by him entitled *Culture and Experience*. This book is in part a collection of brief papers to which new material has been added so as to make it a presentation of his most important ideas within a consistent over-all framework, including his latest contributions to a theory of culture and its relationship to psychological functioning. . . ."

WILFRID E. LE GROS CLARK, professor of anatomy at the University of Oxford. The citation read, "This choice is based on his long and distinguished series of contributions to primatology and human paleontology, running from earlier works as, *Early Forerunners of Man* to his numerous recent studies of Proconsul, Limnopithecus, and the Australopithecinae, and including his widely read and useful *British Museum Handbook: History of the Primates*, and his *Fossil Evidence for Human Evolution*. . . ."

J. ERIC THOMPSON, department of archeology, Carnegie Institution of Washington. The citation read, "J. Eric Thompson is today the outstanding man in Maya ethnology and archeology. He has published many technical and several popular books on the Maya and Aztec. His most recent book is the *Civilization of the Maya*. . . . His archeological researches in British Honduras, Yucatan, and his current work on the Maya calendar system are outstanding. He is a field man of wide experience and a scholar of deep perception and knowledge. His work continues fruitful today as it has been in the past."

GEORGE THOMSON, Corpus Christi College, University of Cambridge, Cambridge, England, will speak at the University of Maryland on 19 Apr. His talk on "The impact of science on modern life: the new industrial revolution" is one of a series of centennial lectures in physics. Other lecturers from abroad in the series have been WALTER E. THIRRING, of the University of Bern, Bern, Switzerland, "Consistency of quantum field theory," and L. LEPRINCE-RINGUST of the Ecole Polytechnique and the University of Paris, Paris, France, "Investigations of heavy mesons and hyperons."

JOHN LEAR is science editor for the new section on science and research that the *Saturday Review of Literature* began in its 24 Mar. issue (see editorial in *Science*, 6 Apr.). Lear has been an associate editor of *Collier's* magazine specializing in science, science feature writer for the Associated Press, and free-lance writer on science for leading national magazines. He has received a number of major awards for distinguished journalism in the field of science, including the AAAS-Westinghouse award in 1951.

PAUL ROSENBERG, president of Paul Rosenberg Associates, consulting physicists, Mount Vernon, N.Y., received the Talbert Abrams award of the American Society of Photogrammetry at the society's annual meeting in Washington, D.C., on 22 Mar.

FRITZ LIPMANN, Nobel prize winner and professor of biochemistry at Harvard University, will be guest lecturer on 7 May at the dedication of the Ireland Research Laboratory, University of North Dakota Medical School.

LOUIS RODDIS, deputy director of the Atomic Energy Commission's Division of Reactor Development, and JOHN LAWRENCE, director of the Donner Laboratory, University of California, Berkeley, are visiting Thailand and Pakistan, and Roddis will visit Turkey, as consultants in connection with the development of atomic energy programs in these countries.

RAYMOND STEVENS, president of Arthur D. Little, Inc., Cambridge, Mass., will receive the gold medal of the American Institute of Chemists at its annual meeting in Boston, 10–11 May, for his "contributions to the wider understanding of essential procedures for the management and operation of industrial research."

GEORGE P. CRESSMAN of the USAF Air Weather Service has received the highest Air Force civilian honor, the decoration for exceptional civilian service for outstanding accomplishment in weather analysis and forecasting. Cressman is director of the Joint Numerical Weather Prediction Unit at Suitland, Md., a facility operated jointly by the Air Force, Navy, and Weather Bureau.

HARVEY M. MERKER, widely known speaker on medical and pharmaceutical subjects and director of scientific relations for Parke, Davis and Company, retired on 29 Feb. after nearly 50 years of service. He joined the firm as a part-time laborer in 1907 while he was still a student.

In 1919 he was promoted to superintendent of manufacturing at the company's Walkerville, Ont., plant, and in 1929 he was named superintendent of manufacturing in Detroit, a post he held for 24 years. Merker became director of inventory control in 1953, and 2 years later was appointed director of scientific relations.

HUGH R. LEAVELL, professor of public health practice and assistant dean at the Harvard School of Public Health, has been granted a year's leave of absence to serve as adviser to the Government of India on problems of community sanitation and child and maternal health. Leavell, who left on 30 Mar., will serve under a grant given by the Ford Foundation to the Indian government. Two health educators, CLAUDIA GALIHER of Washington, D.C., and MARY CHAMPLIN of Pittsburgh, Pa., will work with him in India.

From headquarters in New Delhi, Leavell will help organize a program for training Indian health workers and for evaluating ways in which the cooperation of Indian villagers can best be attained in community health projects. At the same time he will be searching for means to further the teaching of foreign students in the Harvard School of Public Health.

R. B. BRIGGS was appointed director of the Homogeneous Reactor Project at Oak Ridge National Laboratory on 1 Mar. He was formerly associate director of the ORNL Reactor Experimental Engineering Division. He succeeds J. A. SWARTOUT, who has served as director of the homogeneous reactor project since 1951. Swartout will continue his association with the project as chairman of the steering committee.

WENDELL E. REED, project engineer for the Solar Aircraft Company, San Diego, Calif., was awarded the Wright Brothers medal by the Society of Automotive Engineers at its national aeronautical meeting in New York on 10 Apr. His paper "A new approach to turbojet and ramjet engine control," given at SAE's national meeting in Los Angeles last October, was judged the best presentation on aeronautics in 1955. In it Reed described a more reliable control for aircraft gas turbine power plants.

JOSEPH C. AUB, professor of medical research at Harvard Medical School and director of medical laboratories at the Collis P. Huntington Memorial Hospital, has received the Bertner Foundation award for 1956.

Established in 1950 in honor of the late E. W. Bertner, first acting director of M. D. Anderson Hospital and Tumor Institute and the first president of the Texas Medical Center, the award is presented annually for outstanding contributions in the field of cancer research.

CARROLL E. PALMER and LAURENCE IRVING, of the U.S. Public Health Service, were awarded honorary degrees by the University of Oslo, Oslo, Norway, on 13 Mar. The degree, doctor medicinae honoris causa, is awarded by the university once in 5 years to distinguished foreigners.

Palmer, a physician, has spent the major part of his life in research on tuberculosis and other infections of the lung. He has been working recently on the development of a specific preventive for tuberculosis. Irving, a physiologist, has conducted extensive research on methods of adapting human life to arctic temperatures.

EDWARD R. WEIDLEIN retired on 31 Mar. from the Mellon Institute, with which he has been associated for more than 40 years, most recently as president. Following his retirement, he will spend several months in Europe on a Federal Government mission. He will remain on the board of trustees of the institute and will be available to advise on the administration of the institute's research programs.

The author of a large number of scientific papers and articles on industrial research achievements, opportunities, and management, and, with William A. Hamor, of two popular works, Weidlein has received much recognition for his contributions, including many honorary degrees. During World War II, he held a number of wartime and governmental positions. He is deeply interested in all matters pertaining to the improvement of his home city, Pittsburgh, and its environs.

As president of the Mellon Institute, an endowed, nonprofit organization, Weidlein has been cognizant of the research conducted there in chemical and physical technology; in the pure sciences, especially physical chemistry; and in the welfare of the professions concerned. He has also been closely associated with the industrial fellowship system at the Mellon Institute since its formation in 1907, when he was an undergraduate at the University of Kansas.

Recent Deaths

ARMAND W. ANGULE, Upper Darby, Pa.; 55; professor of anatomy at Hahnemann Medical College and Hospital; 21 Feb.

ARTHUR A. BLANCHARD, Brookline, Mass.; 79; former professor of chemistry at Massachusetts Institute of Technology; 25 Mar.

BURGHARD BREITNER, Innsbruck, Austria; 72; head of the surgical department of Innsbruck University from 1932–56; 27 Mar.

WILLIAM CHRISTIANS, Philadelphia, Pa.; 52; professor of geography at the University of Pennsylvania; 13 Mar.

EUGENE C. CRITTENDEN, Washington, D.C.; 75; retired associate director of the National Bureau of Standards; U.S. representative on the International Committee on Weights and Measures from 1946–54; 28 Mar.

JOHN H. GIBBON, SR., Philadelphia, Pa.; 84; professor emeritus of surgery at Jefferson Medical College; 13 Mar.

JOHN C. LYNCH, Bridgeport, Conn.; 93; retired adjunct professor of neurology and mental diseases at New York Post Graduate Medical School; 23 Mar.

HARRY SODERMAN; 53; Tangier; Swedish criminologist and former head of the Institute of Police Science at the University of Stockholm; 16 Mar.

SYDNEY WEINTRAUB, Tappan, N.Y.; 61; professor of clinical radiology at Cornell University Medical College; 24 Mar.

EDMUND T. WHITTAKER, Edinburgh, Scotland; 82; royal astronomer of Ireland, 1906–12; professor of mathematics at Edinburgh University, 1912–46; Hitchcock professor at the University of California, 1934; 24 Mar.

Education

■ The Raytheon Manufacturing Company has established a graduate study program to enable its outstanding employees or prospective employees who are science and engineering graduates to pursue a program of study leading to a master's degree.

Students who are completing their undergraduate studies as candidates for a bachelor's degree in science or engineering may apply in expectation of becoming employees prior to entering the graduate program.

The program grants will include full tuition, fees, book allowance, and a salary while in residence at school equivalent to research assistant salaries afforded individuals employed by the schools. This salary is currently in the neighborhood of $240 per month.

Those interested in applying for this program of study are invited to request further information and application forms from Dr. Ivan A. Getting, Vice President, Engineering and Research, Raytheon Manufacturing Company, Waltham 54, Mass.

■ Two Norelco X-ray Diffraction Schools will be sponsored by the Instrument Division of North American Phillips Company, Inc., during coming months. The 24th weeklong series of sessions will be held at the Hotel Morrison, Chicago,

Ill., 4–8 June. The 25th series of sessions is scheduled for 24–28 Sept. at the Sir Francis Drake Hotel, San Francisco, Calif.

Morning sessions will be devoted to lectures and afternoon meetings will involve laboratory demonstrations with the latest type of equipment. This work will include powder camera techniques, the x-ray diffractometer (diffraction goniometer), and the x-ray spectograph (fluorescence analysis).

On Friday, several speakers will discuss details and methods that are in use in industrial plants and laboratories. No registration fee is charged, and those who wish to attend are urged to register as soon as possible, since accommodations will be limited. For information, write to the North American Phillips Company, Inc., 750 S. Fulton Ave., Mount Vernon, N.Y.

Grants, Fellowships, and Awards

■ Final details of the organization of Atoms for Peace Awards, Inc., have been announced by James R. Killian, Jr., president of Massachusetts Institute of Technology and chairman of the new corporation. This is the first organization set up to make international awards for outstanding contributions to the peaceful uses of atomic energy.

The awards are made possible by a $1 million appropriation of the Ford Motor Company Fund, as a memorial to Henry Ford and his son, Edsel Ford. The awards were first announced in Geneva, Switzerland, during last summer's International Conference on the Peaceful Uses of Atomic Energy [*Science* **122**, 372 (26 Aug. 1955)]. A summary of details of organization and award-making procedures follows:

1) Winners each year will be selected from individuals or organizations anywhere in the world, that, in the opinion of the trustees, have made the greatest contributions to the peaceful uses of atomic energy.

2) The award will consist of a medal, accompanied by a cash honorarium of up to $75,000.

3) The decision of the trustees will be made solely on the basis of the merit of the contributions, wherever found in the world.

4) If the trustees fail to discover a candidate "preeminently meriting" the award in any year, the award and medal may be withheld during that year. In that event, the trustees "may hold the funds available for additional Awards in future years or dispose of that year's funds by grants in the United States of America to advance the science or technology relating to the uses of atomic energy for peaceful purposes."

Trustees of Atoms for Peace Awards, Inc., in addition to Killian, are Detlev W. Bronk, president of the Rockefeller Institute for Medical Research and president of the National Academy of Sciences; Ralph J. Bunche, Under Secretary of the United Nations; Arthur H. Compton, professor and former chancellor, Washington University; Mildred McAfee Horton, former president of Wellesley College, and wartime director of the WAVES; Mervin J. Kelly, president of Bell Telephone Laboratories; and Alan T. Waterman, director of the National Science Foundation.

Nominations for the awards will be received from individuals and organizations, including learned societies, in any part of the world. Appraisals will be based on freely available information, not on classified or secret data.

An advisory committee on nominations, appointed by the trustees from citizens of the United States, will screen candidates and make recommendations for the awards to the trustees, who will make the final selection. Members of the advisory committee are Robert F. Bacher, physicist, director of the Norman Bridge Laboratory at the California Institute of Technology; Robert F. Loeb, professor of medicine at Columbia University; Robert Lovett, general partner, Brown Brothers Harriman and Company, former Under Secretary of State and Secretary of Defense; I. I. Rabi, professor of physics at Columbia University, winner of the Nobel prize in physics (1944); and Charles A. Thomas, president, Monsanto Chemical Company. All questions on nominating procedures should be addressed to the Executive Secretary, Atoms for Peace Awards, Inc., 77 Massachusetts Ave., Cambridge 39, Mass., U.S.A.

■ Imperial Chemical Industries, Ltd., publishers of the quarterly scientific review *Endeavour*, have offered the sum of 100 guineas to be awarded as prizes for essays submitted on a scientific subject. Because the primary purpose of these awards is to stimulate younger scientists to take an interest in the work of the British Association for the Advancement of Science and to raise the literary standard of scientific writing, the competition is restricted to those whose 25th birthday falls on or after 1 June.

Five prizes will be awarded: a first prize of 50 guineas, a second prize of 25 guineas, a third prize of 15 guineas, and two special prizes of 5 guineas for competitors who have not passed their eighteenth birthday on 1 June.

The subjects for the essays are as follows: (i) research in polar regions; (ii) scientific aids to archeology; (iii) the story of steel-making; (iv) the chemistry of big molecules; (v) new elementary particles, and (vi) the control of plant diseases.

The essays, which must be in English and typewritten, should not exceed 4000 words in length; only one entry is permitted from each competitor. The latest date for receipt of entries is 1 June 1956. The essays will be judged by the editor of *Endeavour* in consultation with representatives of the British Association. The successful competitors will be invited to attend the whole of the Sheffield meeting, at which the prizes will be presented, and their expenses within the United Kingdom will be paid. In judging the essays, special attention will be paid to the originality of the approach to the subject, and great importance will be attached to literary style. The competitor's age will also be taken into account. The essay winning the first prize will be published in *Advancement of Science*, journal of the British Association.

The essays must be submitted without signature. The competitor's full name and address and date of birth should be disclosed in a sealed covering letter attached to the essay and addressed to: The Assistant Secretary, British Association for the Advancement of Science, Burlington House, Piccadilly, London, W.1.

■ The American Cancer Society has announced that its program of clinical fellowships will continue through 1957–58, with fellowships beginning 1 July 1957. Fellowships will be made available primarily to teaching institutions whose postgraduate specialty training programs are approved by the Council on Medical Education and Hospitals of the American Medical Association.

The *deadline for filing applications is 1 May*. No application forms are necessary, but letters of application should include (i) number of fellowships applied for; (ii) funds available to the institution from other sources for partial support of fellows; (iii) specialty contemplated for the fellow's training; (iv) name of person under whose supervision the fellow will be trained and to whom he will be directly responsible; (v) date the fellowship will begin; and (vi) a thorough documentation of the training the fellow will receive at the institution, including facilities available.

Clinical fellowships in radiation therapy are offered to properly qualified graduates in medicine who wish to have additional training at certain clinics in the United Kingdom, the Scandinavian countries, and France. Applicants must be citizens of the United States, under 40 years of age, who have previously received training in therapeutic radiology acceptable to the American Board of Radiology as credit toward certification.

The annual stipend is $4500 per year,

including travel. When such a fellowship is awarded, an initial travel fund of $900 will be paid to the recipient. The remainder of the stipend will be paid in advance in monthly installments of $300, beginning with the fellowship period.

The fellowship period will be 1 year, although in exceptional circumstances renewal for a year or less will be considered. Fellowships may begin at any time mutually agreeable to the institution and the fellow. Fellows may choose to spend the entire fellowship year in one institution or to divide the time between two or more; in the latter event, however, at least 8 months must be spent in a single institution.

All arrangements for affiliation with foreign institutions must be made by the fellow or his preceptor directly with the appropriate officials in those institutions after the fellowship is awarded; only the contemplated program need be submitted with the application.

Application forms and further information about both types of fellowship may be obtained from the Professional Education Section, American Cancer Society, 521 W. 57 St., New York 19. Applications must be submitted through the executive officer of the applicant's institution.

In the Laboratories

■ Arthur D. Little, Inc., Cambridge, Mass., acquired the Miner Laboratories, Chicago, Ill., chemical consultants, on 1 Apr. John R. Kirkpatrick, who established the A.D.L. midwest office in 1952, will manage the new A.D.L. Midwest Division–Miner Laboratories. C. S. Miner, Jr., will continue to direct technical operations.

■ A Flight Laboratory for air and ground testing of airborne electronic equipment and systems has been established by the Radio Corporation of America at the New Castle County Airport, New Castle, Del.

The new facility is now in limited operation, and will be completely equipped with maintenance and laboratory test apparatus by May. It will be used for pre-flight and in-flight testing of RCA airborne equipment and fire-control systems for military aircraft. The laboratory will also be used for flights in connection with operational tests of RCA ground radar systems.

■ The National Carbon Company, a division of Union Carbide and Carbon Corporation, received the "Oscar" of the Academy of Motion Picture Arts and Sciences for its contribution to the art of studio lighting. The award was made in recognition of National Carbon's development and production of yellow-flame carbon for motion-picture color photography.

A product of several years of research, the yellow-flame carbon operates at a color temperature of 3350°K, which eliminates the need for heavy filters to provide a white light source balanced to the color characteristics of motion-picture color film.

■ The U.S. Atomic Energy Commission has announced that it has concluded arrangements with the Ohio Oil Company, in association with Arthur E. Pew, Jr., of Philadelphia, under which the commission has given assurance of its willingness to negotiate a contract for purchase of a specified quantity of uranium concentrates to be produced from uraniferous lignites.

Lignites containing significant grades of uranium are known to exist in the western parts of North and South Dakota. However, the lignites cannot be economically treated by the metallurgical techniques applied to standard uranium ores, such as those found in the Colorado Plateau area. The Ohio Oil Company and Pew currently are conducting development work on a process which they believe will be economic for processing the lignites. If they decide to construct a mill, then the commission will enter into negotiations with them for the purchase of the concentrates. Catalytic Construction Company has been retained by Pew and Ohio Oil Company to proceed with pilot-plant operations.

■ Nuclear Science and Engineering Corporation, Pittsburgh, Pa., is building a new and additional laboratory facility on a 3½-acre site near the Allegheny County Airport as part of its expanding program in radiobiology. The department of biology and medicine moved to the new building on 1 Apr. and will continue work in radiation sterilization of food, radiation of sewage, study of radiation effects on living organisms, irradiation-induced toxic factor, and health-physics determinations.

Miscellaneous

■ The Near East College Association has a number of teaching opportunities open, beginning in Sept. 1956, in schools and colleges in Greece, Lebanon, and Turkey. The association has issued an 8-page memorandum listing 28 scientific academic appointments at six institutions, generally for 3-year terms, with salary, transportation, and maintenance.

English is the language of instruction. Some positions require Ph.D.'s, and some M.S. or B.S. degrees. There are three openings in chemistry, two in biology, six in engineering, seven in mathematics, and eight in physics. Those interested should write to S. Elizabeth Ralston, Near East College Association, 40 Worth St., New York 13.

■ The 87 scientific and technical papers on atomic energy that were presented at the Conference on Peaceful Uses of Atomic Energy sponsored by the U.S.S.R. Academy of Science in Moscow, 1–5 July 1955, have been translated and are being published in four volumes.

Volume 1 includes the 23 papers presented at the session of the Division of Physico-Mathematical Sciences on nuclear properties of heavy elements, theoretical and experimental work on uranium-graphite, reactors and lattices, radiation effects, and so forth.

Volume 2 includes the 19 papers presented at the Session of the Division of Chemical Science on high-energy fission and spallation, effects of ionizing radiation on chemical reactions, and application of nuclear techniques to chemical structure and reactivity.

Volume 3 includes the 18 papers presented at the Session of the Division of Technical Science on the application of nuclear technology to industrial processes and prospecting.

Volume 4 includes the 21 papers presented at the Session of the Division of Biological Science on biological and biochemical effects of ionizing radiation and the application of nuclear techniques in biochemical and physiological investigations.

These volumes are available, on public sale, from the U.S. Government Printing Office, Washington 25, D.C., at $4.25 per set.

■ The Association for Applied Solar Energy published the first issue of its newsletter, *The Sun at Work*, in March. The purpose of this quarterly is to provide news of association activities as well as information about people and developments in the field. Guy Beveniste, an economist at Stanford Research Institute, is editor.

The first mailing, consisting of 10,000 copies, was sent to scientists, engineers, architects, and industrialists in 37 countries. Many of these people had attended the World Symposium on Applied Solar Energy that was held last year in Phoenix, Ariz.

The association also plans to issue *The Journal of Solar Energy Research*, which will be a scientific publication for original papers and for extensive abstracts of contributions previously printed elsewhere.

Other recent activities of the association include the operation of a solar energy library and the establishment of a museum of solar energy research.

Reports and Letters

Marginal Homozygosity for Gene Arrangement in Drosophila robusta

Drosophila robusta inhabits the deciduous forest of the eastern United States. Like a number of other endemic species of the genus, most of its natural populations display chromosomal polymorphism due to the presence of inverted sections (*1*). These inversions cover long portions of the chromosomes and are widespread geographically. In some populations, especially those near the center of the species range (Virginia, Tennessee and southern Missouri), the amount of polymorphism is enormous; more than 95 per cent of the wild females are heterozygous for at least one sizable inversion, and some have as many as five inversions, one in each of the six major chromosome arms (*2*).

Recent studies of more or less marginally situated populations (that is, in Georgia-Alabama to the south and Wisconsin-Minnesota to the north) have shown that the degree of chromosomal polymorphism in populations at the edge is much less than it is in populations at the center of the range (*2*). The present note (*3*) reports the existence of a population at the extreme northwest margin of the species range that is essentially homozygous for gene arrangement. This finding is of particular interest because it provides evidence that marginal homozygosity in this species may be a more complete and striking phenomenon than has previously been suspected.

A collection of 281 specimens of *Drosophila robusta* was made 1–3 Aug. 1955 at Chadron State Park, Dawes County, in the northwestern corner of Nebraska. Such a sizable collection of this species in a marginal area is unprecedented in my experience—my attempts to obtain quantitative population samples in supposed marginal sites had been repeatedly unsuccessful in previous years.

Salivary gland chromosome analyses were carried out on F_1 individuals produced by the wild flies after they had been brought to the laboratory; the conventional acetoorcein technique was used. Table 1 gives the results for the five major chromosome arms that display variability in gene sequence in the populations of the central Missouri River Valley. It will be seen that the only chromosome arm that is not structurally homozygous in this population is the right arm of the X chromosome. In this case, moreover, only two instances, or 0.6 percent, of the alternative gene arrangement XR-1 were recorded. The left arm of chromosome 3 is also homozygous. It is not listed separately in Table 1, because no variability is known in it that does not also involve the right arm.

Study of a small sample of flies taken in the same locality in August 1950 (*4*) gave results that are compatible with those obtained in 1955. Of a total of 20 chromosomes tested for each of the chromosome arms listed in Table 1, only one instance of diversity of gene order (another XR-1 gene arrangement) was found.

This extraordinarily high degree of structural homozygosity is of particular interest in view of the special ecological and geographical conditions that exist in the Chadron area. Chadron Creek, along which the collections were made, arises in a series of springs not more than 4 mi above the state park on the northward-facing slope that is known locally as the "Pine Ridge." The flood plain of Chadron Creek in the vicinity of the park does not in most places exceed 100 yd in width. The American elm (*Ulmus americana*), the principal host tree for *Drosophila robusta*, grows abundantly in the narrow strip along the creek but is wholly absent from higher ground. The upland areas in this region support, in addition to a complex short-grass flora, only a moderate growth of western yellow pine (*Pinus ponderosa*). The existence of *Ulmus americana* and *Pinus ponderosa*, growing within a few feet of one another, typifies the meeting of eastern and western biota that occurs in the region. The *Drosophila* fauna likewise shows a mixture of eastern and western forms (*5*). The uplands of the pine ridge area and the treeless sandhills to the south, east, and west form a rigid ecological barrier for *Ulmus*, and the trees inhabiting the valley are clearly at the terminus of a riparian flora that is derived from the valley of the White River, into which Chadron Creek flows. This junction is about 10 mi north of the collecting site in the park and is approximately 5 mi west of the city of Chadron (elevation 3383 ft).

Although collections were not made in the surrounding sand hills, it is inferred that *D. robusta* could not exist there in permanent populations in the absence of a deciduous host tree. The distribution of the fly in this area, as elsewhere, would be expected to parallel that of the species of tree on which it breeds. The White River, after receiving Chadron Creek from the south, flows in a generally northeasterly direction across southern South Dakota and joins the Missouri River about 65 mi southeast of Pierre. Thus, the *D. robusta* populations of the northwestern corner of Nebraska along Chadron Creek and other tributaries at the headwaters of the White River, appear to be linear outposts derived from those of central South Dakota. They would be expected to have affinities with these northern populations, as yet unstudied, rather than with the populations of the more southeasterly drainage basins of Nebraska (for example, Niobrara and Loup rivers).

The suggestion has been made (*6*) that the amount of chromosomal polymorphism present in a particular population of a species is directly proportional to the number of ecological niches exploited by the members of that population. The data on chromosomal polymorphism in *Drosophila robusta* do not contradict this idea (*7*). Quite apart from this consideration, however, the very fact of marginal homozygosity for gene sequence carries important implications for the microevolutionary plasticity of the species. It is now well established that chromosome inversions act primarily as blockers of effective crossing over in the chromosome regions that they cover. From this, it follows that in a population that has very few or no inversions, the process of gene recombination may proceed unhampered, and novel genotypes may be readily synthe-

Table 1. Gene arrangements present in a population of *Drosophila robusta* from Chadron State Park, Neb., in August 1955; 1868 chromosome arms were tested; 674 X chromosome arms and 1194 autosomal arms.

Chromosome	Chromosome arm	Gene arrangements present	No. of each gene arrangement recovered
X	left	XL-1	337
X	right	XR	335
X	right	XR-1	2
2	left	2L-3	398
2	right	2R	398
3	right	3R	398

sized. Where polymorphism is extensive, on the other hand, the gene pool of the species is essentially broken up into a number of smaller gene pools, each of which corresponds to a chromosome arrangement. There is thus less opportunity for the hereditary variability present to undergo extensive free recombination. One may suggest, therefore, that marginal populations that are essentially homozygous for gene arrangement may be of special interest in evolutionary studies because they have a chromosomal system that allows maximum recombination by crossing over. They would appear to be peculiarly well suited for the attainment of future evolutionary advance.

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6 October 1955

Influence of White Blood Cells on Lysis of Red Cells by Cobra Venom

It has been known since the early studies of Kyes (*1*) that snake venom hemolysis exhibits a species specificity. The difference in susceptibility of cells has been attributed by some to availability of intracellular lecithin for the action of venom lecithinase. On the other hand, it has not been possible to correlate lecithinase activity of venoms with their hemolytic activity (*2*). A recent discussion of the problem suggests that the facts are best reconciled in the idea that venoms contain, in addition to lecithinase, a lysin that has a direct hemolytic action (*3*). This view was apparently shared by Landsteiner, who compared the action of venoms on red cells with that of the phytoagglutinins and natural antibodies (*4*). The mode of the direct action of a native venom is still unexplained (*2*).

In the course of certain studies (*5*) on splenic cells, it has been found that washed red cells from the spleens of rabbit, swine, and ox are rapidly lyzed by traces of cobra venom although the erythrocytes of the peripheral blood are completely, or almost completely, unaffected by venom in comparatively high concentration. Evidence has been found that this apparently selective action on splenic cells is conditioned by the presence of leucocytes in the red-cell suspensions.

Table 1. Action of venom on splenic cells. Peripheral blood tested in same way showed no hemolysis whatever.

Time (min)	Venom dilution ($\times 10^3$)							Control
	4	8	16	32	64	128	256	
20	+++	++++	++++	0	0	0	0	0
40	++++	++++	++++	++++	++++	+++	0	0
60	++++	++++	++++	++++	++++	++++	0	0

* ++++ = complete hemolysis.

Cobra (*Naja naja*) venom (*6*) stored as a dry powder was serially diluted for tests in 0.85-percent saline containing 0.02*M* phosphate buffer. Unless otherwise stated, *p*H was 7.4. To conserve material, the lowest venom dilution used was generally 1/4000 or 1/8000.

In some experiments, an animal lecithin (Eastman Kodak Co.) emulsion in buffer was added to the system in a volume of 0.1 ml containing 50 μg of lecithin.

Spleens and defibrinated blood of ox and swine were obtained from the slaughterhouse, and cell preparations were made within 1 or 2 hours of death. For studies of rabbit cells, freshly killed animals were used.

Cells of peripheral blood were washed three times in saline and made up to a 1- or 2-percent suspension. Fat and capsule were dissected from spleens, and cell suspensions were made by shaking teased-out pulp in saline. The cells were similarly washed.

Tests for hemolysis were made by adding 0.1 ml of cell suspension to 1 ml of venom dilution. The test tubes were placed at 37°C and read for hemolysis at intervals for 1 to 2 hours, and finally after an overnight interval at 4°C.

The selective action of venom on spleen cells is shown as a typical experiment with ox cells in Table 1. In eight such experiments with the ox, the peripheral blood cells showed hemolysis only once, in the 1/8000 dilution, and not until after 60 minutes of incubation. On the other hand, splenic cell suspensions were invariably hemolyzed rapidly in titers of venom ranging from 1/32,000 to 1/512,000.

Entirely similar findings were obtained with cell preparations from rabbit and swine, but since ox spleens were easier to work with, further studies were made on cell preparations from this animal alone.

It was found that hemolysis of splenic blood was maximum at *p*H 7.4 to 7.9 and that it decreased with lowering of *p*H, disappearing at *p*H 6.0. The lecithinase activity of the venom was tested by adding lecithin to venom and peripheral blood cells, which then hemolyzed rapidly. It was found that the optimum *p*H of this system is also in the range 7.5 to 7.9, and that activity decreases on acidification. Thus, the action of venom on splenic blood and on lecithin could not be distinguished in terms of *p*H optima.

White-cell counts were performed on many suspensions being tested, and random samplings were taken from those showing lysis and from controls. The number of leucocytes in the control tubes of splenic blood usually numbered 20,000 to 40,000/mm³, while the corresponding preparations of peripheral blood had less than 200. When the content of white cells in spleen blood was reduced by repeated differential centrifugation, it could be shown that lysis of erythrocytes was slow and might fail altogether if the number of white cells fell below about 500/mm³.

Conversely, it was found that leucocytes concentrated from peripheral whole blood could bring about lysis when they were added to a suspension of red cells that were otherwise insusceptible to the action of venom.

It was of some interest to note that lysis of the white blood cells did not appear to be essential for this effect. Table 2 shows that in the tubes containing the two highest dilutions of venom, the final white-cell counts were comparable to the controls even though hemolysis was ob-

Table 2. Final white counts on venom-splenic cell system.

Expt.	Venom dilution ($\times 10^3$)						Controls	
	8	16	32	64	128	256	C_1	C_2
Lysis	++++	++++	++++	++++	++++	++++		
White count ($\times 10^3$)	2.2	2.5	2.3	2.8	8.4	12.0	8.4	5.1

served. This suggested that the leucocytes might be supplying an enzyme activator that was released from whole cells. This question has been pursued only to the point of establishing that the ash from leucocytes will not substitute for living cells.

It seems clear that the presence of a critical number of leucocytes, about 500/mm³, will potentiate hemolysis by venom of red cells that are otherwise insusceptible. This finding may be taken into account in studies of the mechanisms of venom lysis. It could perhaps explain some of the curious species specificities hitherto attributed to venoms in their action on erythrocytes.

The precise contribution of white cells to the lytic system is not clear. The white cells may contribute lecithin for the formation of lysolecithin. On the other hand, they might furnish an activator for some other lytic system. It is possible, in either case, that species differences in white cells may at times be more important in determining specificity than differences in red cells.

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11 October 1955

Nonspecificity of ATP-Contraction of Living Muscle

Adenosine triphosphate (ATP) induces contraction both in living muscle and in muscle models (*1–4*). In contrast to muscle models, ATP contraction of the intact muscle cell depends on membrane activation; ATP injected intracellularly is ineffective in altering mechanical state (*2*). Muscle is not unique in being spontaneously excited by ATP; firing of sympathetic ganglia and of anterior horn cells after application of this and related compounds has been reported (*5, 6*).

It can be shown that contraction produced by ATP in intact, isolated striated muscle is nonspecific in nature and depends on the removal of ionic calcium from the bathing medium. It is well known that lowering calcium in the external medium results in spontaneous muscle twitches (*7, 8*). Calcium forms a complex ion with ATP, the dissociation constant of which is considerably lower than that formed with citrate (K for CaATP complex is 8.7×10^{-5} moles/lit; for Cacitrate complex, it is 6.1×10^{-4} moles/lit) (*9, 10*). In order to show that the effect of ATP is due to calcium binding, it is necessary to demonstrate (i) that at the threshold concentration of ATP, the free calcium-ion concentration is sufficiently low to result in spontaneous activity, and (ii) that the results conform to the predictions of the mass-law equation when both initial external calcium and ATP are varied. The experiments were performed on the isolated curarized sartorius of *Rana pipiens*.

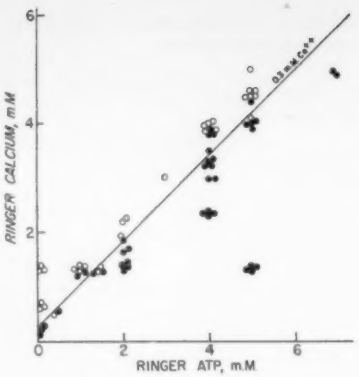

Fig. 1. Relationship of threshold concentration of ATP to Ringer calcium. Based on the mass law, the 0.3mM Ca^{++} line has been drawn. The points indicate the composition of Ringers solution for each muscle tested. Closed circles represent muscles that exhibited spontaneous activity, open circles those that did not.

An equilibration period of ½ hour in Ringers solution was allowed before transfer to the test Ringers solution. Muscle fibers were observed under the microscope for evidence of shortening. When a portion of the calcium in the Ringers solution is omitted, spontaneous twitching occurs in 50 percent of the muscles tested at 0.3mM Ca^{++}. Threshold concentrations for spontaneous activity were 1.3mM ATP or 2.6mM citrate (sodium salts) in normal Ringers solution. From the dissociation constants, ionic calcium was calculated to be 0.3mM. Thus the first criterion appears to be satisfied. The mechanical response to low calcium, ATP, or citrate was indistinguishable. At threshold concentrations, there were repetitive twitches of fibers and occasional tetanic bursts.

The next series of experiments was designed to determine how the threshold concentration of ATP varies with altered initial Ringer calcium. From an equation derived from the mass law,

$$Ca = \frac{[Ca^{++}][ATP]}{[Ca^{++}] + K} + [Ca^{++}]$$

where Ca is the total concentration of calcium, Ca^{++} is the concentration of ionic calcium, ATP is the total concentration of ATP and K is the dissociation constant of the CaATP complex, one can obtain a series of isoionic calcium lines when Ca is plotted against ATP. In Fig. 1, the line for Ca^{++} equal to 0.3mM has been drawn. The points are experimental and indicate the composition of the test Ringers solution for each muscle. The closed circles represent muscles that exhibited spontaneous activity, the open circles those that did not. All points above the line would lie on lines in which ionic calcium was greater than 0.3mM, and conversely for those below. On the whole, the results conform to the predictions based on the mass law.

If the action of ATP is to remove ionic calcium to a critical level, taking into account biological variation, one would expect an S-shaped curve when the percentage of muscles that showed spontaneous activity is plotted against Ca^{++} (Fig. 2). The points on the solid curve were obtained by calculation from the mass-law equation as ATP and Ringer calcium were varied. Points on the broken curve were obtained as Ringer calcium alone was varied. The two curves appear identical. These experiments indicate that ATP-induced contraction is correlated with a critically low calcium-ion concentration. No such correlation is found between the concentration of free (unbound) ATP and contraction (Fig. 3).

The similarity of the stimulating action on ganglia of ATP and low calcium was noted by Feldberg and Hebb (*5*). In harmony with the evidence presented here is the demonstration that inhibition of bone calcification by ATP is due to cal-

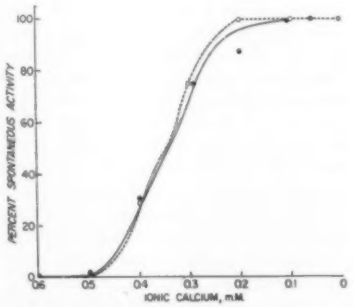

Fig. 2. Relationship of spontaneous activity to ionic calcium concentration. Broken curve: Ringer calcium alone was varied; solid curve: ionic calcium was changed by varying Ringer ATP and calcium.

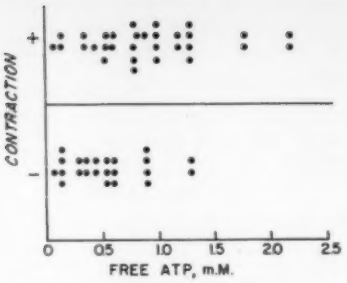

Fig. 3. Absence of correlation between the concentration of free ATP and contraction.

cium binding (*9*). It may be concluded that, in the case of muscle, calcium in the form of its ATP complex is not available to stabilize the muscle membrane. The action potentials so evoked set off the contractile process. Thus the effect of ATP applied to living muscle is unrelated to contraction per se.

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27 September 1955

High Incidence Blood Group Found in Venezuelan Indians

To date no single blood group found exclusively in discrete geographic or ethnical human divisions has been described. It is only through the incidence of the well-known blood groups that the various human stocks can be characterized in a general way (*1*). We present here (*2*) data on the incidence of what appears to be a new blood system with possible anthropological implications.

In 1954, Levine, Koch, McGee, and Hill (*3*) mentioned a new "private" blood factor called "Diego," which was detected in the serum of a Venezuelan woman who had been sensitized through several pregnancies. They found that this serum produced agglutination of the husband's red cells but did not agglutinate the red cells from 200 North American persons. Lately, with no further comments, this finding has been quoted in other publications (*4*). This year, serum was collected during a new pregnancy of the original patient, giving us an opportunity to study the incidence of the Diego factor in her husband's relatives and in various representative sections of the Venezuelan population.

In the study of the family (Ca. family) in which this factor was originally detected, we found eight positive cases out of 29 tested. In the general population from Caracas, we were surprised to find that several unrelated individuals carried this factor. Inquiry about the ancestry and physical features of the various positive cases and of the Ca. family revealed the probability that they all possessed ancestors from Carib Indian stock. The results of 826 tests in groups of people from various Venezuelan regions are given in Fig. 1. They were tested against anti-Diego serum by the indirect Coombs test.

It would seem that the Diego factor is not a "private" blood group, but rather that its incidence is high in Indians, especially in Carib Indians, and in people with mixed Indian ancestry. Since the Indians studied came originally from Brazil, it could be that this factor is prevalent in Brazil and other neighboring countries. The Indian element enters in a high proportion of the general Venezuelan population. This probably explains the positive tests found in the populations of Caracas and Barcelona. The cases found in the Negro population studied may also be explained by mixture with Indians.

From the genetic point of view, the study of the Ca. family and of several Indian families shows that the factor is inherited as a dominant Mendelian character with no sex linkage (examples in Fig. 2). The factor may be followed in some cases through several generations (four in one of the families). Apparently, the antibody is not of the naturally occurring type but is an immune "incomplete" one. Detailed study of the positive cases show that the antibody (anti-Diego

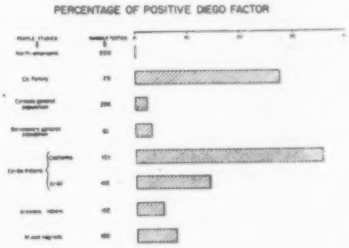

Fig. 1. Results of 826 tests.

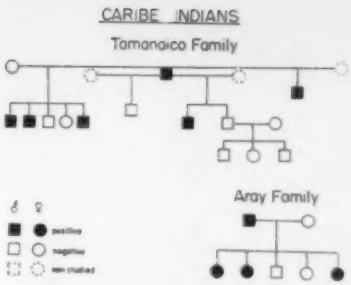

Fig. 2. Examples of genetic studies.

serum), which can be called anti-Di^a, was developed by a homozygous Di^b/Di^b (Mrs. Ca., the original patient). The individuals who reacted against the anti-Diego serum were Di^a/Di^b or Di^a/Di^a, indicating that this blood system is formed by at least two allelic genes. We can postulate that eventually anti-Di^b will be found.

If in the future it can be demonstrated that the Diego factor occurs exclusively or predominantly in Indian populations, it would be wise to change the name of this antigen to a more correct one, such as "Indian factor," related to its anthropological implications.

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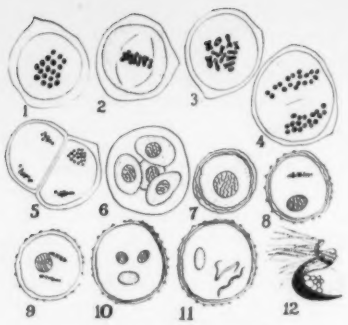
26 September 1955

Spiral Male Nuclei in Ragweed Pollen

Stamens from ragweed (*Ambrosia*) growing on the premises of the Southern Illinois University were stained with iron-acetocarmine solution and observed under the microscope at 1000 diameters magnification. At the metaphase of the first meiotic division of the pollen mother cell, 18 round chromosomes were counted. Since the basic number of chromosomes in Compositae is nine, it is not surprising that the chromosome number of the ragweed is $n = 18$.

The chromosomes are regularly arranged on the equatorial plane of the first meiotic division (Figs. 1 and 2). At diakinesis, chiasmata were observed in



Figs. 1–12. Ragweed pollen.

every bivalent chromosome (Fig. 3). At the end of the first anaphase, the partition wall begins to appear between the two newly formed chromosome groups (Fig. 4); at the end of the second division, it is clearly apparent (Fig. 5).

When the tetrad is formed, each cell changes into a pollen grain with a thick cell wall (Figs. 6 and 7). After the first division of the pollen nucleus, a vegetative nucleus and a germ nucleus are produced, and the germ nucleus once more divides into two male nuclei (Figs. 8–10).

Each of the two male nuclei gradually change into the long, banded, sharp-pointed structures. One side of the banded nucleus is stained especially deeply. the band-shaped nuclei form spirals and resemble the spindle-shaped spermatozoids of a fern or a moss (Fig. 11). I have studied the cytomorphological features of many species of ferns (*1*), and a spermatozoid of *Alsophila martensiana* (Fig. 12) shows some resemblance to the male nucleus of ragweed (*2*). The male nucleus of Angiospermae corresponds to the spermatozoid of a fern or a moss, and it is interesting from the viewpoint of phylogeny that the male nuclei of an *Ambrosia* should show a spiral form.

In *Fritillaria* (*3*), in *Lilium* (*4*), and in *Monotropa* (*5*), the male nuclei become spiral-shaped after they enter the embryo sac, but this is the first instance in which the male nucleus of a higher plant has been found to exhibit a spiral form in the pollen.

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* Fulbright grantee (1955) from the University of Tokyo.

3 October 1955

Genus Haemagogus in the United States

We have been engaged during the past 6 years in the study of the tropical American mosquitoes of the genus *Haemagogus* (Diptera, Culicidae) that are associated with the wave of sylvan yellow fever that passed through Panama during the period 1948–51 and in 1954 reached the north coast of Honduras.

In the course of field work in Middle America, we came to realize that this genus, which had been studied primarily in the tropical rain forests of South America, includes species characteristic of very different ecological situations. In southern Mexico, near Tuxtla Gutierrez, we found two species of *Haemagogus* at elevations in excess of 4000 feet, associated with a semiarid scrub-type of vegetation. This led us to believe that there were members of the genus that might inhabit similar situations at lower elevations to the north of the Tropic of Cancer. We have been interested in determining the northern limits of the distribution of these mosquitoes because of their implication in the transmission of sylvan yellow fever.

After reviewing available information on the physiography, climatology, and vegetation of the Mexican gulf versant, we selected several areas in the Rio Grande basin for survey in late August and early September of last year, when rainfall and temperature conditions would be most favorable for the breeding of *Haemagogus* (*1*). One of these areas was the delta region of the Rio Grande in the vicinity of Brownsville, Tex. This area is largely under intensive cultivation, but we were able to find occasional patches of thorny scrub vegetation along relatively moist depressions that are locally known as "resacas." Larvae and pupae of *Haemagogus equinus* were collected from water in three tree holes in a patch of thorn scrub off Texas State Highway 48 near the intersection with Farm Road 1792, 5 miles northeast of Brownsville (4 and 6 Sept. 1955); and from a tree-hole 15.7 miles east of Brownsville on Boca Chica Boulevard (6 Sept. 1955). By 8 Sept., adult males and females had already emerged. This material will be deposited in the United States National Museum and the collection of the Gorgas Memorial Laboratory. Because of the pressure of other field work scheduled in Mexico, no attempt was made to seek *Haemagogus* futher north in Texas.

Haemagogus equinus, which occurs at least as far south as Colombia, is a proved vector of yellow fever in the laboratory, but virus has not been recovered with certainty from it in nature. It was, however, the only species of *Haemagogus* found by us in immediate association with the epizootic of yellow fever on the northern coast of Honduras in 1954 (*2*).

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27 September 1955

Loss of Sebaceous Glands in Skin of Thiamine-Deficient Mice

To study the effects of thiamine deficiency in mouse skin with resting or growing hair follicles, approximately 60 young adult C57 black mice of both sexes were used. The mice were kept in individual wire metabolism cages and offered tap water ad libitum.

Two kinds of thiamine-deficient diets were used—diet 227 (Table 1), obtained from Paul Fenton of Brown University (*1*) and a diet purchased from General Biochemicals, Inc. (Table 2). Pair-fed animals—that is, animals fed the normal diet in amounts equal to those consumed by their respective paired mates that were fed the thiamine-deficient diet, served as controls.

Biopsy specimens were removed on approximately the 7th, 14th, and 21st days of the deficiency regimen. The skin was shaved, and approximately 1 cm^2 was removed, spread on a piece of cardboard, cut in half, and fixed in 10-percent formol calcium. One half was prepared for histological study and stained in an

Table 1. Components of diet 227. In the control diet, 10 mg of thiamine was added to each 1000 g of diet 227.

Component	Amount
Casein (vitamin-free)	300 g
Dextrin	500 g
Salts (Hubbel *et al.*)	50 g
Corn oil	50 g
Vitamin supplement per 1000 g of diet	
Pyridoxine	10.0 mg
Riboflavin	20.0 mg
Nicotinic acid	50.0 mg
Biotin	0.2 mg
Folic acid	5.0 mg
Pantothenic acid	100.0 mg
Vitamin A	10,000 U.S.P. units
Vitamin D	1,000 U.S.P. units
Vitamin E	50.0 mg
Vitamin K	10.0 mg
Choline	1.50 gm

Table 2. Components of diet purchased from General Biochemicals. In the control diet, 10 mg of thiamine was added to each 1000 g of the GBI diet.

Component	Amount
Sucrose	68%
Casein, vitamin-free (GBI)	18%
Vegetable oil (hydrogenated)	10%
Salt mixture U.S.P. XIV	4%
Vitamin supplement (g/100 lb)	
Vitamin A conc. (200,000)	4.500 g
Vitamin D conc. (400,000)	3.000 g
Alpha-tocopherol	10.215 g
Choline chloride	272.400 g
Niacin	27.240 g
Inocitol	13.620 g
2-Methyl-1, 4-naphthoquinone	0.1021 g
Pyridoxine HCl	0.9534 g
Riboflavin	0.9534 g
Calcium pantothenate	2.0430 g

aqueous solution of toluidine blue, and the other half was stained for lipids in a solution of sudan black B. A total of 95 biopsy specimens was studied.

To insure that the mice would possess hair follicles at the proper stage of hair growth throughout the course of the experiments, club hairs were plucked from the resting follicles. Plucking of club hairs initiated a new wave of hair growth that required approximately 19 days for completion (*2*) in the plucked area only. The mice were placed on the thiamine-deficient diet at 21 days after plucking. The hairs at this time had just completed their growth and entered the resting phase and would remain in the resting phase for about 1 month (*2*). After 7 or 14 days of the deficiency regimen, one half of the dorsum of each mouse was again plucked, and in this replucked area hair growth was again initiated. Thus, throughout the remainder of the experiment, one half of the dorsum of each mouse had growing follicles and the other half had resting follicles.

Mice that were fed the deficient diet tended to increase in weight throughout the first week and level off during the second. About the 14th day, a progressive loss of weight began, and death occurred between the 21st and 25th days. Concomitant with the decrease in weight in the third week, the hair coat lost its smoothness, and the hairs felt dry to the touch. Although the pair-fed control animals lost much weight, their hair coat remained smooth and oily.

Biopsy specimens of skin from both deficient and pair-fed control animals showed essentially a normal appearance 7 days after the initiation of the deficiency regimen.

Skin that possessed growing or resting follicles, removed from both groups of mice at 14 days, exhibited a general atrophy that is primarily the result of a decrease in the size of the panniculus adiposus. The epidermis and its appendages were not appreciably reduced in size, and there was abundant lipid within the sebaceous gland.

Between the 21st and 25th days of the deficiency, a marked atrophy of the skin was seen, irrespective of whether the skin had growing or resting follicles. The panniculus adiposus had disappeared, the epidermis was reduced to a single thin layer of cells covered by a thin film of keratin, and the hair follicles, both growing and resting, were decreased in size. The sebaceous glands had atrophied, occasionally leaving a thin shell of flattened cells comprising the peripheral, basal, and undifferentiated cells of the gland. Lipid could not be demonstrated in these remnants of the glands (Fig. 1). Occasionally, however, a plug of lipid was seen in the duct of the gland and hair canal, which probably represents sebum previously synthesized but not extruded.

The pair-fed controls also showed a loss of the panniculus adiposus and a general decrease in size of the epidermis and its appendages. However, the sebaceous glands, although reduced in size, were intact, and intracellular lipid was demonstrable (Fig. 2).

One possible explanation for the loss of the sebaceous glands is that they are holocrine glands. In order to synthesize sebum, they need a constant supply of energy and materials to be used for mitosis and for the synthesis of the sebum. It is now established that the energy for mitosis of the cells of the epidermis and its appendages is produced to a great extent by the activity of the Krebs citric acid cycle (*3*). Since thiamine is an integral component of the Krebs cycle and of steps in intermediary metabolism leading into the cycle, a deficiency of this key component could conceivably disrupt or impair the function of the energy-producing mechanism. The loss of available energy would make continued mitosis impossible, and therefore, without continued cell replacement, the sebaceous gland would atrophy.

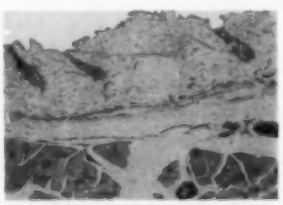

Fig. 1. Sudan black B preparation of skin 24 days after the initiation of the deficiency regimen. No sebaceous glands are present. × 50.

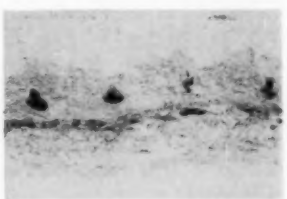

Fig. 2. Pair-fed control 22 days after initiation of deficiency regimen. Black areas are portions of the sebaceous glands stained for lipids with sudan black B. × 50.

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3 October 1955

Congenital Galactosemia, a Single Enzymatic Block in Galactose Metabolism

The pathway of galactose to glucose-1-phosphate includes the following steps (compare Leloir, *1*, and Munch-Petersen *et al.*, *2*): (i) phosphorylation of galactose; (ii) incorporation into nucleotide; (iii) inversion of the 4-hydroxyl group; and (iv) release of glucose-1-phosphate. The following scheme summarizes these consecutive reactions (*3*):

$$\text{Gal}^* + \text{ATP} \rightarrow \text{Gal}^*\text{-1-P} + \text{ADP} \quad (1)$$

$$\text{Gal}^*\text{-1-P} + \text{UDPG} \rightleftharpoons \text{G-1-P} + \text{UDPGal}^* \quad (2)$$

$$\text{UDPGal}^* \rightleftharpoons \text{UDPG}^* \quad (3)$$

$$\text{UDPG}^* + \text{PP} \rightleftharpoons \text{UTP} + \text{G}^*\text{-1-P} \quad (4)$$

The enzymes that catalyze these four reactions are galactokinase, PGal-uridyl transferase, Gal-waldenase, and PP-uridyl transferase, respectively. Because the galactose was labeled with C^{14} (the asterisks indicate the C^{14}-labeling of the hexose moiety), the equations illustrate how this sugar is finally brought into the general carbohydrate metabolism.

Schwartz *et al.* (*4*) have described that galactose administration to infants who are afflicted with congenital galactosemia brings about a marked accumulation of a galactose-1-phosphate in the erythrocytes.

Most recently it has been found (*5*, *6*) that hemolyzates from infants with congenital galactosemia are devoid of the enzyzme in Eq. 2, PGal-uridyl transferase. However, it was not possible at that

time to state whether the step of Eq. 3, the inversion, was also absent because neither normal nor galactosemic hemolyzates showed any detectable amounts of galacto-waldenase. The problem whether galactosemia is a one-enzyme or a multi-enzyme defect, or whether a different pathway of galactose metabolism is operating as compared with normal individuals, could therefore not be sufficiently clarified at that time. Meanwhile, E. Maxwell, working in our laboratory, found that purified galacto-waldenase from calf's liver requires diphosphopyridine nucleotide (DPN) as a cofactor (*7*). This finding prompted us to add DPN to human hemolyzates in order to see whether galacto-waldenase might be present, but not yet detected because of the absence of its coenzyme (DPN) (*8*).

As shown in Table 1, it is indeed possible to demonstrate galacto-waldenase in hemolyzates from both normal and galactosemic subjects if DPN is also added. It appears that the lack of galacto-waldenase activity in crude hemolyzates is not due primarily to the destruction of DPN but mainly to a greatly increased requirement of galacto-waldenase for the coenzyme (*9*).

It can be seen from Table 1 that the activity of galacto-waldenase is of the same order of magnitude in the hemolyzates from galactosemic subjects as it is in those from normal.

Table 2 summarizes the average activities found for the various enzymes involved in the galactose metabolism of human hemolyzates. The galactokinase activity was measured according to a new sensitive and specific method that has not yet been published (*10*).

The lack of PGal-uridyl transferase and the presence of galactokinase in the hemolyzates of blood from galactosemic subjects is in full accordance with the fact that galactose-1-phosphate accumulates in the erythrocytes of such patients if galactose (or milk) is administered (*4*). The presence of the freely reversible step of Eq. 3 in hemolyzates from galactosemic subjects would explain why normal development is possible (compare Mason and Turner (*11*) in these patients on galactose-free diets at an age when appreciable amounts of brain galactolipids are synthesized. These observations provide additional evidence for the fact that congenital galactosemia represents a block that is confined exclusively to a single enzyme, PGal-uridyl transferase. Genetic studies (*12*) indicate that the disease is presumably of hereditary origin and that it seems to be the result of a single recessive gene or of a more complex genetic pattern.

Table 1. Activity of galacto-waldenase in hemolyzates, with and without added DPN; 0.07 μmole of UDPGal are incubated with 0.5 ml hemolyzate corresponding to 0.25 ml of erythrocytes, 50 μl of 1*M* glycine at *p*H 8.7. Incubation time 15 min, at 37°C; DPN either omitted or added in amounts corresponding to 1 μmole. Total volume 0.6 ml. The activity is expressed as μmoles UDPG formed and UDPGal consumed (compare Kalckar *et al.*, *6*).

Condition of subjects	Enzyme activity (μmoles/ml hr)	
	No DPN	DPN
Normal (avg. of 3 cases)	0.002	0.32
Galactosemic (avg. of 3 cases)	0.002	0.35

Table 2. Activity of the four hemolyzate enzymes that catalyze the reactions of Eqs. 1, 2, 3, and 4 of the reaction scheme. Activity is given in micromoles of reactants converted per milliliter of lyzed erythrocytes, per hour.

Condition of subjects	Galacto-kinase		PGal-uridyl transferase		Gal-waldenase		PP-uridyl transferase	
	Subjects (No.)	Activity (Avg.)	Subjects (No.)	Activity (Avg.)	Subjects (No.)	Activity (Avg.)	Subjects (No.)	Activity (Avg.)
Normal	3	0.10	15*	0.82	3	0.32	9	1.20
Galactosemic	3	0.08	10	0.02	3	0.35	8	1.85

* This figure also includes infants that were on galactose-free diets (*5*, *6*).

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3. The following abbreviations are used: Gal, Galactose; Gal-1-P, galactose-1-phosphate; G-1-P, glucose-1-phosphate; UDPG, uridine diphosphoglucose; UDPGal, uridine diphosphogalactose; ATP, adenosine triphosphate; ADP, adenosine diphosphate; UTP, uridine triphosphate; PP, pyrophosphate.
4. V. Schwartz *et al.*, *Biochem. J. London* **62**, 34 (1956).
5. H. M. Kalckar, E. P. Anderson, K. J. Isselbacher, *Proc. Natl. Acad. Sci. U.S.* **42**, 49 (1956).
6. ———, *Biochem. et Biophys. Acta*, in press.
7. E. S. Maxwell, *J. Am. Chem. Soc.*, in press.
8. Bodil Waage-Jensen rendered valuable technical assistance as a trainee under the American-Scandinavian Foundation through a grant-in-aid that was generously made available to one of us (H.M.K.) by the Eli Lilly Laboratories.
9. Unpublished experiments show that hemolyzates, even after heat inactivation, bring about a marked increase in the requirements of galacto-waldenase for DPN. This applies to the enzyme present in erythrocytes as well as to purified liver galacto-waldenase. If the norite eluate (nucleotide fraction) from a hemolyzate filtrate was tested with purified liver galacto-waldenase, it was found that by this new highly sensitive assay (*7*) sufficient amounts of DPN were present to bring about an almost optimal rate of reaction. By this assay method, the amount of DPN present in filtrates of hemolyzates is estimated to be 0.05 to 0.1 μmoles/ml in accordance with Leder and Handler [in *Phosphorus Metabolism*, W. D. McElroy and B. Glass, Eds. (Johns Hopkins Univ. Press, Baltimore, 1951), vol. 1, p. 421]. However, in order for the galacto-waldenase to be activated in the presence of crude hemolyzates, a large excess of DPN must be added. In the series of experiments cited in Table 1, a 250-fold excess over the amount of DPN that gives an effect on purified galacto-waldenase was used.
10. K. Kurahashi, unpublished.
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27 February 1956

Correction

In the article "Absorption and metabolism of iron" [*Science* **123**, 87 (20 Jan. 1955)], the wavelength of maximum absorption of the iron-siderophilin complex was incorrectly given as 520 millimicrons. On page 89, the first sentence in the second paragraph under the heading "Iron transport" should read "The Fe^{+++}-B_2-globulin complex has a characteristic salmon-pink color with a maximum light absorption at 460 millimicrons. . . ."

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I am more and more convinced that our happiness or unhappiness depends far more on the way we meet the events of life than on the nature of those events themselves.—KARL VON HUMBOLDT.

Book Reviews

The Biochemistry of Semen. T. Mann. Methuen, London; Wiley, New York, 1954. 240 pp. Illus. + plates. $2.90.

In the prefatory remarks, T. Mann states: "Biochemistry of semen is a relatively modern but rapidly expanding field of physiology; consequently, many of our present views, particularly as regards the biological significance of various chemical constituents of semen, may have to be revised or modified in the near future. That being so, I like to look upon this book, or at any rate those parts of it which deal with the newer, still fluid concepts, as something in the nature of an Interim Report, designed to furnish information and to convey ideas emerging from the state of knowledge as available at the time of writing, however imperfect that may be." I think the epitome of excellent scientific judgment was achieved in the author's preface, especially since approximately 950 references, 33 of which were by himself, embrace his textual facts. Moreover, Mann is a pioneer investigator in this field, and his signature affixed to a compact, monumental book such as this one suffices to give authenticity to his descriptive analysis of our present-day knowledge of the biochemistry of semen.

The Biochemistry of Semen is divided into nine chapters: "The two components of semen: spermatozoa and seminal plasma"; "Chemical and physical properties of whole ejaculated semen"; "The influence of extraneous factors, hormones, and environmental conditions"; "Intracellular enzymes"; "Protein constituents and enzymes of the seminal plasma"; "Lipids and their role in the metabolism of semen"; "Fructose and fructolysis"; "Spermine, choline, ergothioneine, and certain other bases in semen"; and "Citric acid and inositol."

I particularly enjoyed reading the chapter on the influences of extraneous factors, hormones, and environmental conditions on semen. It is interesting to note the progress made in this area during the past 100 years. In this connection, Koelliker's 1856 paper "Physiologische Studien über die Samenflüssigkeit" is a good landmark for tenable comparisons. Most of the present-day reports on semen reflect largely upon Koelliker's early observations. The extension of his early work is largely endocrinological.

This book is very concise and in some areas it is much too telegraphic. The numerous references are presented in an intelligent manner, and the author evaluates many of them for the reader. It is my idea that the book could have been richly enhanced with more illustrative material and shorter tables. In the final analysis, *The Biochemistry of Semen* very carefully summarizes the biochemical knowledge of a very complex area of the endocrinology of reproduction.

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Topley and Wilson's Principles of Bacteriology and Immunity. 2 vols. G. S. Wilson and A. A. Miles. Williams & Wilkins, Baltimore, ed. 4. 1955. xlviii + 2331 pp. $24.50.

The preface states that this book was intended originally for the general student of medicine and biology but that the character of the fourth edition has been changed. The treatise is now designed for postdoctoral students, teachers, and research workers who are interested in the microbiology of infection.

The text has been expanded by 277 pages, but the outline is unchanged, with 93 chapters divided into four parts: "General bacteriology" (432 pp.); "Systematic bacteriology" (664 pp.); "Infection and resistance" (253 pp.); and "The application of bacteriology to medicine and hygiene" (870 pp.). As many as 500 references are cited in certain chapters, and a few of these are as late as 1953–54. An index of 48 pages is included in both volumes. The number of tables has been reduced by 11 (to 196), and the figures, several of which are new, have been increased by one (to 303).

In part I new material has been added to nearly every chapter. Although a few statements have been added to the chapter on history, the latest reference cited is 1938. Topics such as the tricarboxylic acid cycle, transamination, and phosphorylation are not listed in the index, and one has to hunt in the chapter on nutrition and metabolism to find a discussion of these topics. The continuous-culture technique for stabilizing microbial populations at a given growth phase is not mentioned in the chapter on growth and death of bacteria.

Expansion in part II is greatest in the chapters dealing with pure-culture methods and the identification of bacteria. The other chapters describe the characteristics of approximately 40 bacterial genera, the animal viruses, and related microorganisms. The Salmonella section has been enlarged to cover the antigenic description of more than 300 serotypes. The genus *Bacterium* is retained for the coli-aerogenes group.

Part III is enlarged most in the chapters on anaphylaxis, hypersensitivity and allergy, the antibody-forming apparatus, natural antibodies, immunity to virus diseases, and mechanisms in immunity. The sections on measurement of immunity and on herd infection and immunity are good.

Part IV contains chapters on the normal flora of the human body, the various microbial diseases of man and animals, and the bacteriology of air, water and sewage, and milk. The text, figures on mortality indices, and tabular data on some diseases, such as tuberculosis and poliomyelitis, are current, whereas similar information on other important diseases is demoded.

In a book dealing with a broad and rapidly expanding field there are bound to be omissions. It is nearly impossible for two people to keep abreast in all the areas covered. Those who grew up with the earlier editions of this book will continue to use it as an indispensable encyclopedia. Younger people will find the mass of basic material a bit overwhelming but nevertheless easy to read.

There are remarkably few errors in the book and the illustrations and printing are of highest quality.

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Functional Analysis. Frigyes Fiesz and Bela Sz.-Nagy. Translated from the French ed. 2 by Leo F. Boron. Ungar, New York, 1955. 468 pp. $10.

This is a translation of the excellent textbook originally published by the Hungarian Academy of Science. This book is obviously the result of years of research and teaching on the part of its outstanding authors. There is no book in the field that can be compared with it. Frequent use is made of the pedagogic device of proving results at a simple level and then showing later how a few modifications

in proof generalize the result to less restricted cases.

The first third of the book is nominally on integration theory but actually covers far more. Linear functionals in L^p and C are covered, as are the Banach-Steinhaus and Hahn-Banach theorems. Finally, positive linear functionals are considered, culminating in the Radon-Nikodym theorem.

The Fredholm integral equation of the second kind is treated in L^2 by the Schmidt method, Fredholm's method, and a more abstract method based on complete continuity. Generalization is then made to Hilbert and Banach spaces, and applications are given. The symmetric case is then treated. Interesting and elegant applications are made to potential theory and almost periodic functions.

The spectral theory for bounded symmetric, unitary, and normal transformations in Hilbert space is given by two methods, the one of Riesz and the other of Nagy. Unbounded transformations are then considered and the spectral decomposition is obtained for self-adjoint transformations followed by extensions of symmetric transformations. The functional calculus of self-adjoint transformations and the perturbation of the spectrum are treated. A chapter on groups and semigroups of transformations follows, including the results of Stone and of Hille-Yosida. Ergodic theory is also presented. The final chapter treats spectral theories for linear transformations of general type giving applications to results of Wiener, Beurling, Gelfand, and von Neumann.

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Gas Kinetics. An introduction to the kinetics of homogeneous gas reactions. A. F. Trotman-Dickenson. Academic Press, New York; Butterworths, London, 1955. 322 pp. Illus. $8.

In this relatively short book, the author gives a useful summary of the working equations of current theories of the rates of homogeneous gas-phase chemical reactions, a critical review and tabular summaries of experimental results (with the exclusion of reactions by molecular oxygen), and a detailed description and evaluation of several recently developed experimental methods.

After an introductory chapter, which includes a few tables of heats of formation, bond energies, and so forth, there is a long chapter on theories of chemical kinetics. This book is the first one to review N. B. Slater's theory of unimolecular reactions, and, after a full presentation of its features but not a derivation, a critical review is given of its advantages and disadvantages. A detailed presentation, again without derivation, of the transition-state theory is given, and use (mostly qualitative) is made of this theory throughout the book. There is a brief presentation of the collision theory of bimolecular reactions with reference to a convenient source of its derivation. The problem of energy transfer between molecules is emphasized and discussed in the language of Slater's theory. The critical presentation of these theories without derivation makes this chapter very full and rich, an excellent source of equations; but the book can hardly be described in terms of its subheading, "an introduction to the kinetics of homogeneous gas reactions."

The author's organization, presentation, and evaluation of experimental results (pp. 64–309) are outstandingly efficient and mature. In a typical family of reactions, there is given a rather detailed description of the experimental apparatus, a full mechanism that the author believes to cover the possibilities, a thorough discussion of the key reaction or else of a typical reaction in the series, an analysis of probable and possible errors both in the experiment and in the mechanism, and finally a complete table (sometimes five entries, sometimes 80) of all reactions in the series. Usually, these useful tables are resolved into elementary reactions, including activation energies and preexponential factors (these two quantities the author defines as "rate factors"); references are given for each entry; and often the author inserts an evaluation of the "reliability." The author has obviously worked through and recalculated a large number of key articles.

In judging a book of this type, which gives a critical condensation of a broad field, another worker in the field may agree or disagree with the author concerning specific evaluations, emphases, or omissions. Personally, I particularly liked Trotman-Dickenson's careful definitions of *elementary reactions, order,* and *mechanism*, but the definition of *rate* was surprisingly clumsy and uncertain; apparently the author is unaware of the well-established de Donder notation for the rate of reaction. The book, to its credit, contains frequent warnings against errors due to surface reactions, especially for slow reactions, low pressures, small bulbs; but there is no warning against the equally serious errors due to thermal gradients [S. W. Benson, *J. Chem. Phys.* **22**, 44 (1954)], which are worst for fast reactions, high pressures, large bulbs. It was a distinct disappointment to see the author on page 271 agree with the old treatment of the reaction $2NO + O_2$ with its out-of-scale 5-A bond lengths which supposedly undergo a grand free internal rotation; with methods of modern molecular spectroscopy one can do much better than this 20-year-old first approximation.

In spite of my disagreement on a few technical details, I regard this as one of the best books in the field.

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Active Transport and Secretion. Symposia of the Society for Experimental Biology, No. VIII. R. Brown and J. F. Danielli, Eds. Academic Press, New York, 1954. vi + 516 pp. Illus. $8.

This book is the printed series of papers read at a symposium of the Society for Experimental Biology held in Bangor. It is the eighth of an annual series of symposium reports and combines in a single volume the research and thinking of outstanding investigators in the field of active transport, using both animal and plant material.

The first two reports, by J. A. Ramsay and Hugh Davson, are concerned with water and electrolyte movements in invertebrates and vertebrates, respectively, and the next contains a discussion by Thomas Rosenberg of how "active transport" should be defined. Davson mentions the experimental problem posed by fluids, such as the aqueous humor of the eye, which differ very slightly but significantly from those to be expected in a simple ultrafiltrate of plasma. Rosenberg "does not regard questions of terminology as a mere formality. Hazy definitions . . . are often the main obstacles to attempts to gain further theoretical and practical insight."

The next four papers are concerned primarily with movement of water. J. R. Robinson and J. A. Kitching present experimental data from a number of forms, the latter discussing "Animals without kidneys." Robinson stresses his view of nonequilibrium concentrations of water in extracellular and intracellular fluids in the same animal. J. W. L. Beament discusses water transport through model membranes and in insects, including the phenomenal ability of an ultrathin layer of wax to conserve water. D. C. Spanner suggests a means by which water transport could conceivably occur through temperature gradients while, at the same time, he recognizes the very serious objections to such a view. He is impressed, as others have been, by the very small temperature difference that is equivalent in effect to a large pressure difference.

A group of four papers on active transport in the erythrocyte follows. Paul G. LeFevre considers monosaccharides and

quantitative aspects of a membrane-carrier transport mechanism. W. Wilbrandt, in a general discussion of the transfer of a wide range of compounds through the epithelial cells of the kidney tubule and intestine, arrives at a membrane-carrier type mechanism the features of which are then illustrated by results on sugar transport in erythrocytes. Montague Maizels and E. J. Harris cover cation transport. The latter states in conclusion, "Results obtained for human red cells indicate that a single mechanism brings about active sodium ion extrusion and active potassium ion accumulation."

Three chapters on microorganisms, by Aser Rothstein, E. F. Gale, and P. Mitchell, include the uptake of sugars by yeast, the accumulation of amino acids and the transfer of phosphate, probably $H_2PO_4^-$, within staphylococcal cells. The extent and selectivity of the amino acid accumulation is especially striking.

H. Lundegardh contributes one of the longer reports in describing his pioneering studies covering many years of work on the ion absorption and transport of root tips, primarily spring wheat. His interpretation in terms of "anion respiration" through the cytochrome system is also described. Three further studies on plants are then presented. J. F. Sutcliffe is concerned with cation absorption by nongrowing beet disks. R. Scott Russell extends Lundegardh's idea of cytochrome oxidase as the energy source for ion accumulation to ascorbic acid oxidase, the principal terminal oxidase in barley roots. Although he concludes that energy for active accumulation of electrolytes may come from this system also, he does not interpret the experimental results in the same terms of "anion respiration." The final paper of this group, by F. C. Steward and F. K. Miller, considers salt accumulation at both the cellular and plant levels of organization. In the first portion, the authors have as their aim the discovery of the relation in growing cells between water and salt accumulation on the one hand and respiration and protein synthesis on the other. Both dividing and nondividing tissues are included.

Hans Ussing reports on his work with frog skin, in which current from the short-circuited skin is equivalent to sodium ion transport. In addition, he finds effects of atropine, TEPP, and so forth, suggesting possible similarities between sodium ion transport in frog skin and the extrusion of sodium ion by nerve. Some of the extremely illuminating work on cation transport in nerves by A. L. Hodgkin and R. D. Keynes is described by them in the succeeding paper.

E. J. Conway presents his "redox-pump" theory of active transport through membranes as well as experimental work on sodium and potassium transport in yeast, sodium ion excretion by, and localization in, skeletal muscle, and the formation of gastric hydrochloric acid. A report by H. Burr Steinbach entitled "The regulation of sodium and potassium in muscle fibers" is followed by three papers in new and old fields that have received relatively little attention. These are a consideration of the exciting properties of mitochondrial preparations by R. E. Davies, (incidentally, the captions under two figures on page 460 have been reversed), the transport of proteins by F. W. R. Brambell and W. A. Hemmings and of lipids by A. C. Frazer. The final paper is a thoughtful analysis of certain morphological and molecular aspects of transport by J. F. Danielli.

The collection of reports illustrates the great advances that have been made experimentally and conceptually in developing the parts of a systematic transport physiology. It also makes readily available for study a wealth of material covering many aspects of this highly significant field. For the reader, it would have been easier if the different authors had given more direct attention to correlating or contrasting their own views with the views of others actually expressed at the conference. Although there were presumably many interesting and informative reactions to the papers of others on the part of the highly qualified persons in attendance, these, except for Danielli's, are not often reflected in the published volume.

RUBERT S. ANDERSON
Medical Laboratories,
Army Chemical Center, Maryland

Proceedings of the 1954 Glasgow Conference on Nuclear and Meson Physics. Sponsored by the International Union of Pure and Applied Physics. E. H. Bellamy and R. G. Moorhouse, Eds. Pergamon Press, New York–London. 1955. ix + 352 pp. Illus. + plates. $9.50.

This volume records the papers of the 1954 Glasgow conference, which took place under the auspices of the International Union of Pure and Applied Physics.

The papers, of which there were just over 100, are arranged in eight sections: nuclear forces and nucleon scattering; nuclear data and nuclear models; photodisintegration; beta- and gamma-ray transitions; π-mesons; field theory; high-energy experimental technique; and heavy mesons and hyperons.

The editors state in the preface that most of the discussion, suitably edited, appears after the relevant paper but, for reasons of economy, papers often could not be fully reported. In particular diagrams were heavily cut.

New Books

The Warfare of Democratic Ideals. Francis M. Myers. Antioch Press, Yellow Springs, Ohio, 1956. 261 pp. $3.50.

Traité de Zoologie. Anatomie, Systématique, Biologie. Tome XVII, *Mammifères.* Les Ordres: Anatomie, Éthologie, Systématique. Fascicules I and II. Pierre-P. Grassé, Ed. Masson, Paris, 1955. 2300 pp. Paper, 2 vol., F. 22,000; cloth, 2 vol., F. 23,600.

Electronic Data Processing for Business and Industry. Richard G. Canning. Wiley, New York; Chapman & Hall, London, 1956. 332 pp. $7.

La Prospection de l'Uranium. Manuel pratique à l'usage de tous. Préface du Marcel Roubault. Commissariat à l'Énergie Atomique. Masson, Paris, 1955. 59 pp. F. 450.

Between the Planets. Fletcher G. Watson. Harvard University Press, Cambridge, Mass., rev. ed., 1956. 188 pp. $5.

Poliomyelitis. Papers and discussions presented at the third International Poliomyelitis Conference. International Poliomyelitis Congress. Lippincott, Philadelphia–Montreal, 1955. 567 pp.

Principles of Renal Physiology. Homer W. Smith. Oxford University Press, New York, 1956. 237 pp. $5.

Reduction with Complex Metal Hydrides. Norman G. Gaylord. Interscience, New York–London, 1956. 1046 pp. $15.

Dictionary of Arts and Crafts. John L. Stoutenburgh, Jr. Philosophical Library, New York, 1956. 259 pp. $6.

Champs de Vecteurs et de Tenseurs, Introduction à l'électro-magnétisme. Edmond Bauer. Masson, Paris, 1955. 201 pp.

Logic and Scientific Methods. An introductory course. Herbert L. Searles. Ronald, New York, ed. 2, 1956. 378 pp. $4.25.

Théorie Générale de L'Équation de Mathieu et de Quelques Autres Équations Differentielles de la Mécanique. Robert Campbell. Masson, Paris, 1955. 272 pp. Paper, F. 2400; cloth, F. 2900.

Chimie Physique Nucléaire Appliquée. Jacques Errera. Masson, Paris, 1956. 226 pp. F. 2100.

L'Évolution de la Lithosphere. I, *Pétrogénèse.* Henri Termier and Geneviève Termier. Masson, Paris, 1956. 654 pp. Paper, F. 8000; cloth, F. 8800.

Propagation des Ondes dans les Milieux Périodiques. Léon Brillouin et Maurice Parodi. Masson, Paris; Dunod, Paris, 1956. 347 pp. Paper, F. 4000; cloth, F. 4600.

Electronics. An introduction for the nontechnical reader and student to all aspects of electronics in this modern age of science. A. W. Keen. Philosophical Library, New York, 1956. 256 pp. $7.50.

The Harvey Lectures, 1954–1955. Delivered under the auspices of the Harvey Society of New York. Series L. Academic, New York, 1956. 421 pp. $8.

The Language of Modern Physics. An introduction to the philosophy of science. Ernest H. Hutten. Allen & Unwin, London; Macmillan, New York, 1956. 278 pp. $3.75.

Blur of the Retinal Image. Glenn A. Fry. Ohio State Univ. Press, Columbus, Ohio, 1955. 120 pp.

Elementary Differential Equations. William Ted Martin and Eric Reissner. Addison-Wesley, Cambridge, Mass., 1956. 260 pp. $5.50.

The World of Atoms. An introduction to physical science. J. J. G. McCue, with the assistance of Kenneth W. Sherk. Ronald, New York, 1956. 659 pp. $6.50.

Dynamics of Machinery. James B. Hartman. McGraw-Hill, New York, 1956. 283 pp. $7.50.

Proceedings of the International Conference on the Peaceful Uses of Atomic Energy. vol. 2, *Physics; Research Reactors.* 471 pp. $8. vol. 14, *General Aspects of the Use of Radioactive Isotopes: Dosimetry.* 305 pp. $6.50. United Nations, New York, 1956 (order from Columbia University Press, New York 27).

Rocks and Minerals. Everyday Handbook Series. Richard M. Pearl. Barnes & Noble, New York, 1956. 275 pp. $1.95.

Chemistry in Action. George M. Rawlins and Alden H. Struble. Heath, Boston, ed. 3, 1956. 591 pp. $4.40.

A Textbook of Practical Organic Chemistry including Qualitative Organic Analysis. Arthur I. Vogel. Longmans, Green, London, ed. 3, 1956. 1188 pp. 60s.

The Focused Interview. A manual of problems and procedures. Robert K. Merton, Marjorie Fiske, Patricia L. Kendall. Free Press, Glencoe, Ill., 1956. 186 pp. $3.

The Essentials of Educational Statistics. Francis G. Cornell. Wiley, New York; Chapman & Hall, London, 1956. 375 pp. $5.75.

The Chemistry of Tanning Processes. K. H. Gustavson. Academic, New York, 1956. 403 pp. $9.

Anesthesia, Thief of Pain. Sylvan M. Shane. Vantage, New York, 1956. 87 pp. $2.50.

Treatise on Invertebrate Paleontology. pt. P, *Arthropoda* 2. Chelicerata with sections on Pycnogonida and Palaeoisopus. Leif Størmer, Alexander Petrunkevitch, Joel W. Hedgpeth. Prepared under the guidance of the Joint Committee on Invertebrate Paleontology. Geological Society of America and Univ. of Kansas Press, New York and Lawrence, Kansas, 1955. 181 pp. $3.50.

Educational Psychology in the Classroom. Henry Clay Lindgren. Wiley, New York; Chapman & Hall, London, 1956. 521 pp. $5.

Yellow Fever Vaccination. WHO Monogr. Ser., No. 30. World Health Organization, Geneva, 1956 (order from Columbia Univ. Press, New York 27). 238 pp. $5.

My Hobby is Photography. Don Langer. Hart, New York, 1956. 128 pp. $2.95.

Faster, Faster. A simple description of a giant electronic calculator and the problems it solves. W. J. Eckert and Rebecca Jones. McGraw-Hill, New York, 1955. 160 pp. $3.75.

Advances in Applied Mechanics. vol. 4. H. L. Dryden and Th. von Kármán. Academic, New York. 1956. 413 pp. $10.

Clinical Electrocardiography. pt. 1, *The Arrhythmias.* With an atlas of electrocardiograms. Louis N. Katz and Alfred Pick. Lea & Febiger, Philadelphia, 1956. 737 pp.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

High Voltage Electron-Beam Processing. Bull. E. High Voltage Engineering Corp., Cambridge, Mass., 1956. 32 pp.

Symposium on Myasthenia Gravis (Reprinted from *The American Journal of Medicine,* vol. XIX, Nov. 1955, pp. 655–742). Henry R. Viets and George D. Gammon, Guest Eds. Myasthenia Gravis Foundation, New York, 1955.

Expédition Océanographique Belge dans les Eaux Côtières Africaines de l'Atlantique Sud. (1948–1949). Résultats Scientifiques. vol. III, fascicule 4, *Larve de Cérianthaire. Sphaeranthula Straeleni g. nov., sp. nov.* Eugène Leloup. 246 pp. *Exploration Hydrobiologique du Lac Tanganika. (1946–1947). Résultats Scientifiques. Characeae.* Richard D. Wood. vol. IV, fascicule 2. 82 pp. Institut Royal des Sciences Naturelles de Belgique, Bruxelles, 1955.

Conference on the Administration of Research, Proceedings of the Ninth Annual. 7–9 Sept. 1955. Northwestern University Technological Institute, Evanston, Ill. New York University Press, New York, 1956. 107 pp. $4.

Psychiatric Research Reports. 2, *Approaches to the Study of Human Personality.* Nathan S. Kline, Consultant Ed. American Psychiatric Assoc., Washington, 1956. 176 pp. $2.

Saline Water Conversion. Annual report of the Secretary of the Interior for 1955. U.S. Dept. of the Interior, Washington, 1956. 78 pp.

The Flint-Chattahoochee-Apalachicola Region and Its Environments. Bull. Florida State Museum, Biological Sciences, vol. I, No. 1. T. H. Hubbell, A. M. Laessle, and J. C. Dickinson. University of Florida, Gainesville, 1956. 72 pp.

Instrumentation for Geophysical Research. No. 5. *Lovotron—A Low Voltage Triggered Gap Switch.* E. H. Cullington, W. G. Chace, and R. L. Morgan. 13 pp. *Proceedings on the Conference on Atmospheric Electricity.* Held at Wentworth-by-the-Sea, Portsmouth, N.H., 19–21 May 1954. Geophysical Research Papers No. 42. Robert E. Holzer and Waldo E. Smith, Eds. 247 pp. *Near-Infrared Transmission Through Synthetic Atmospheres.* Geophysics Research Papers No. 40. John Nelson Howard, Darrell L. Burch, and Dudley Williams. 244 pp. *The Stability of a Simple Baroclinic Flow with Horizontal Shear.* Geophysical Research Papers No. 38. Leon S. Pocinki. Geophysics Research Directorate, Air Force Cambridge Research Center, Cambridge, Mass. (order from Office of Technical Services, Washington 25). 78 pp.

Biology and Control of the Peach Twig Borer (Anarsia lineatella Zeller) in Utah. Bull. 379. Charles J. Sorenson and Farrell H. Gunnell. 19 pp. *Needs for and Methods of Drainage: Logan, Hyde Park Benson Area, Utah.* Special Rept. 11. Orson W. Israelsen, Cleve H. Milligan, and A. Alvin Bishop. 27 pp. Agricultural Experiment Station, Utah State Agricultural College, Logan, 1955.

Supplement to the Catalogue of the Vascular Plants of S. Tome. Arthur Wallis Exell. 58 pp. 12s. 6d. *The Cephalopoda of Madeira.* Records and distribution. W. J. Rees and G. E. Maul. *Notes on the European Species of Eledone.* W. J. Rees. Bull. of the British Museum (Natural History) Zoology, vol. 3, No. 6. 37 pp. 16s. *The Monotypic Genera of Cichlid Fishes in Lake Victoria.* Bull., Zoology, vol. 3, No. 7. 39 pp. 10s. *A Revision of the Hydroid Genus Perigonimus M. Sars, 1846,* and *On Three Northern Species of Hydractinia.* Bull., Zoology, vol. 3, No. 8. William J. Rees. 28 pp. 10s. *The Lizard Genus Aprasia: Its Taxonomy and Temperature-Correlated Variation.* Bull., Zoology, vol. 3, No. 9. pp. 363–385. H. W. Parker. 23 pp. 6s. *The Brachyopid Labyrinthodonts.* Bull., Geology, vol. 2, No. 8. David Meredith Seares Watson. 78 pp. £1. British Museum (Natural History), London, 1956.

Russian-English Glossary of Metallurgical and Metal-Working Terms. Communist Bloc Program E/55–16. Center for International Studies. Massachusetts Institute of Technology, Cambridge, 1955. 175 pp.

CERN, Laying of Foundation Stone. Signature of the agreement with the Swiss Federal Council, 10–11 June 1955. European Organization for Nuclear Research, Geneva, 1955. 42 pp.

Nature and Gravitation. J. Athanasius Weisheipl. Albertus Magnus Lyceum, River Forest, Ill., 1955. 124 pp.

Fund for Adult Education, Annual Report 1954–1955. The Fund, New York. 48 pp.

Poliomyelitis Vaccination. A preliminary review. WHO Tech. Rept. Ser., No. 101. World Health Organization, Geneva, 1956. 40 pp. $0.30.

Radioactive Deposits in California. Spec. Rept. 49. George W. Walker, Tom G. Lovering, Hal G. Stephens. California Department of Natural Resources, San Francisco 11, 1956. 38 pp. $0.50.

Petrographic Constitution of the Meigs Creek No. 9 Coal Bed. Rept. of investigations No. 27. Gilbert H. Cady and Gilbert E. Smith. 1955. 97 pp. *An Application of Business Machine Technique to Stratigraphic and Coal Resources Studies.* Information Circ. No. 18. William H. Smith, Russell A. Brant, Marian S. Klein. 1956. 26 pp. $0.25. Ohio Division of Geological Survey, Columbus.

National Advisory Committee on Research in the Geological Sciences, Fifth Annual Report 1954–55. Including survey of current research in the Geological Sciences in Canada, 1954–55. Geological Survey of Canada, Ottawa, 1955. 151 pp. $0.50.

International Union for the Protection of Nature, Proceedings and Papers of the Fourth General Assembly. Statutory Meetings. The Union, Brussels, 1955. 67 pp.

Underwater Physiology Symposium Proceedings. Loyal G. Goff, Ed. National Academy of Sciences–National Research Council, Washington, 1955. 153 pp. $1.50.

Nutrition Research Laboratories, Coonoor (South India), Annual Report for 1954–55. Indian Council of Medical Research, New Delhi, India, 1955. 36 pp.

Scientific Meetings

Federation Meetings

The Federation of American Societies for Experimental Biology, comprised of the American Physiological Society, American Society of Biological Chemists, American Society for Pharmacology and Experimental Therapeutics, American Society for Experimental Pathology, American Institute of Nutrition, and American Association of Immunologists, will hold its 40th annual meeting 16–20 Apr. in Atlantic City, N.J. An attendance of 6500 scientists from the United States and Canada is expected.

Headquarters will be Chalfonte-Haddon Hall, and scientific sessions will be held in Convention Hall and adjacent hotels. An exhibits section in the main arena of Convention Hall will feature recent researches of the pharmaceutical, chemical, foods, publishing, apparatus, and equipment industries, as well as displays of member scientists and institutions.

More than 2000 papers will be presented in 185 scientific sessions, symposia, and panel discussions. There will be 18 intersociety sessions, including one symposium, representing an integration of the disciplines of the six member societies on the topics of blood clotting, radiation biology, atherosclerosis, cholinesterase, and tumors. The symposium will be concerned with toxicological and nutritional studies of irradiated foods.

The joint session of the Federation, sponsored by the American Institute of Nutrition, the host society, will be concerned with the clinical, biochemical, and dietary aspects of nutrition and cardiovascular disease. George R. Cowgill, chairman of the Federation, will also be chairman for the joint session; speakers will be L. N. Katz, C. B. Anfinsen, Jr., and F. J. Stare.

The 50th anniversary symposium of the American Society of Biological Chemists will feature 25 years' progress in virus composition and structure, developing chemical concepts in genetics, nucleic acid biosynthesis, bacteriophage as nucleoproteins, structure of ribonuclease, and enzymatic synthesis of similar polynucleotides.

The Histochemical Society and the Society for Artificial Internal Organs will hold their annual scientific meetings 15–16 Apr. in conjunction with the Federation meetings. Special interest groups have arranged dinner meetings and informal discussions throughout the week, and on 19 Apr. the Division of Research Grants of the National Institutes of Health will sponsor a panel discussion on "Interpretation of data obtained in studies with isotope-labeled proteins of biological significance."

The Public Information Committee of the Federation will sponsor two special sessions in Philadelphia on the evening of 20 Apr. for high-school biology teachers and undergraduate college students. Members of the Federated Societies will participate in these programs, which are intended to inform the teachers and students of opportunities in biology as a career; each session will be followed by a question and answer period.

Meeting Notes

■ The American Psychiatric Association will hold its 112th annual meeting at the Hotel Morrison in Chicago, Ill., 30 Apr.–4 May. About 4000 psychiatrists are expected to attend. R. Finley Gayle, Jr., professor of psychiatry at the Medical College of Virginia, will call the meeting to order and deliver the presidential address.

During the week 116 papers will be presented. Many scientific exhibits, films, and other special features are scheduled. Of special interest will be an exhibit of the life and works of Sigmund Freud, which was assembled by the American Psychoanalytic Association on the occasion of Freud's 100th birthday.

■ Nonlinear circuit analysis is the topic of the sixth of a series of annual international symposia that is to be held 25–27 Apr. at the Engineering Societies Building in New York. It is organized by the Microwave Research Institute of the Polytechnic Institute of Brooklyn, with the cooperation of the Institute of Radio Engineers Professional Group on Circuit Theory and with the cosponsorship of the Air Force Office of Scientific Research, the Office of Naval Research, and the Signal Corps.

The program will consider basic methods and recent advances in the analysis and design of nonlinear networks and will emphasize the use of nonlinear network theory in the study of oscillators, feedback systems, switching and discontinuous systems, and nonlinear systems with random inputs. An exposition of the fundamental mathematical methods of analysis will be correlated with applications in such fields as automatic control, where specific practical systems illustrate such nonlinear phenomena as subharmonic generation, parametric damping, jump resonance, and stabilized oscillation.

No registration fee will be charged. Proceedings will be published in Oct. 1956 as volume 6 of the institute's symposia series. For information write to Ernest Weber, Microwave Research Institute, 55 Johnson St., Brooklyn 1, N.Y.

Forthcoming Events

May

1–2. National Acad. of Economics and Political Science, Washington, D.C. (D. P. Ray, George Washington Univ., Washington 6.)

4. American Assoc. of Spectrographers, 7th annual, Chicago, Ill. (J. P. Merutka, H. M. Harper Co., 8200 Lehigh Ave., Morton Grove, Ill.)

4. Annual Conf. for Engineers, Columbus, Ohio. (H. A. Bolz, College of Engineering, Ohio State Univ., Columbus 10.)

4–5. Chi Beta Phi National Convention, Charleston, W.Va. (C. B. Park, Dept. of Chemistry, Lenoir-Rhyne College, Hickory, N.C.)

4–5. Minnesota Acad. of Science, annual, Minneapolis. (B. O. Krogstad, Science and Mathematics Div., Univ. of Minnesota, Duluth Branch, Duluth 5.)

4–5. Wisconsin Acad. of Sciences, Arts, and Letters, annual, Milwaukee. (R. J. Dicke, 3 King Hall, Univ. of Wisconsin, Madison 6.)

4–6. Oklahoma Acad. of Science, Quartz Mountain State Park. (D. E. Howell, Entomology Dept., Oklahoma A. & M. College, Stillwater.)

6–9. American Inst. of Chemical Engineers, New Orleans, La. (F. J. Van Antwerpen, AIChE, 25 W. 45 St., New York 36.)

7–8. New Orleans Acad. of Science, annual, New Orleans, La. (Father J. H. Mullahy, S.J., Dept. of Biological Sciences, Loyola Univ., New Orleans 18.)

8–10. Symposium on Chemistry and Biology of Purines, London, England (invitational). (G. E. W. Wolstenholme, Ciba Foundation, 41 Portland Pl., London, W.1.)

9. American Acad. of Arts and Sciences, annual, Cambridge, Mass. (R. W. Burhoe, 28 Newbury St., Boston 16, Mass.)

9–12. Virginia Acad. of Science, annual, Richmond, Va. (F. F. Smith, Box 1420, Richmond 11.)

10. Assoc. of Vitamin Chemists, Chi-

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cago, Ill. (M. Freed, Dawes Products, 4800 S. Richmond, Chicago 32.)

10–11. American Inst. of Chemists, annual, Boston, Mass. (L. Van Doren, AIC, 60 E. 42 St., New York 17.)

10–11. Atomic Energy Conf., San Antonio, Tex. (E. Wiggin, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.)

10–11. Operations Research Soc. of America, 4th annual, Washington, D.C. (H. J. Miser, Rt. 2, Box 211, Vienna, Va.)

10–12. National Science Fair, 7th annual, Oklahoma City, Okla. (J. H. Kraus, Science Clubs of America, 1719 N St., NW, Washington 6.)

11–12. Indiana Acad. of Science, Martinsville. (W. A. Daily, Eli Lilly Research Laboratories, Indianapolis 6, Ind.)

14–15. Soc. of American Military Engineers, 36th annual, Washington, D.C. (SAME, 808 Mills Bldg., Washington 6.)

14–17. Symposium & Exhibit on Recent Developments in Research Methods and Instrumentation, 6th annual, Bethesda, Md. (J. B. Davis, National Institutes of Health, Bethesda 14.)

14–19. Assoc. of Official Seed Analysts, Sacramento, Calif. (R. G. Colborn, Seed Div., Dept. of Agriculture, Capitol Bldg., Lincoln, Nebr.)

14–19. International Spectroscopical Colloquium, 6th, Amsterdam. (F. Freese, Laboratorium voor Analytische Chemie, 125 Nieuwe Achtergracht, Amsterdam.)

15–16. Industrial Nuclear Technology Conf., Chicago, Ill. (INT Conf., Armour Research Foundation, 10 W. 35 St., Chicago 16.)

16–18. American College of Cardiology, 5th annual, Chicago, Ill. (P. Reichert, Empire State Building, New York, N.Y.)

16–18. Soc. for Experimental Stress Analysis, Pittsburgh, Pa. (W. M. Murray, Massachusetts Inst. of Technology, Cambridge 39.)

17. Maryland Acad. of Science, annual, Baltimore. (T. King, MAS, Enoch Pratt Free Library, Baltimore 1.)

18–26. World Cong. on Fertility and Sterility, 2nd, Naples, Italy. (C. D. Guerrero, Melchor Ocampo 487, Mexico, D.F. Mexico.)

19–20. Population Assoc. of America, annual, Ann Arbor, Mich. (H. Carter, National Office of Vital Statistics, Public Health Service, Washington 25.)

20–22. Building Research Inst., 5th annual, Niagara Falls, Ontario, Canada. (W. H. Scheick, BRI, 2101 Constitution Ave., Washington 25.)

20–22. International Cong. of Neo-Hippocratic Medicine, Montecatini Terme, Italy. (Dr. Valente, 41 Av. Verdi, Montecatini, Terme.)

20–24. American Assoc. of Cereal Chemists, New York, N.Y. (C. L. Brooke, Merck & Co., Inc., Rahway, N.J.)

21–23. American Trudeau Soc., 51st annual, New York, N.Y. (Miss E. Lovell, National Tuberculosis Assoc., 1790 Broadway, New York 19.)

21–24. Air Pollution Control Assoc., Niagara Frontier, annual, Buffalo, N.Y. (H. C. Ballman, APCA, 4400 Fifth Ave., Pittsburgh 13, Pa.)

(*See issue of 16 March for comprehensive list*)

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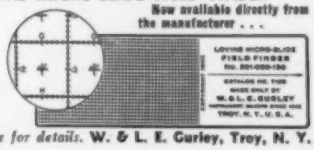

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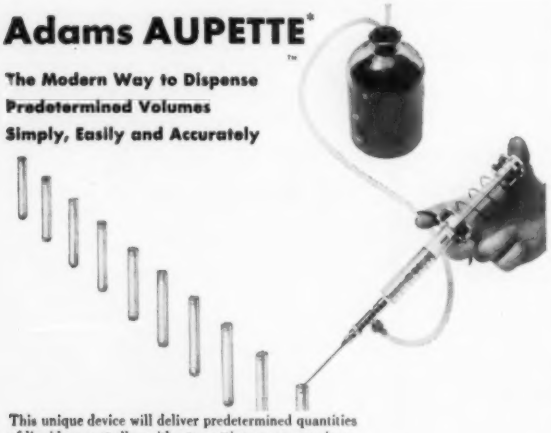

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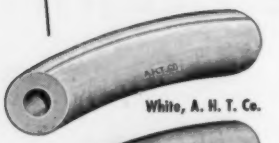
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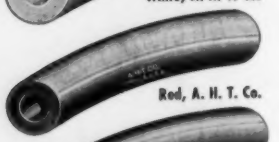
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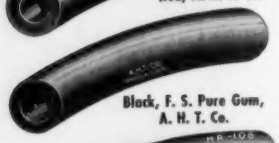
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